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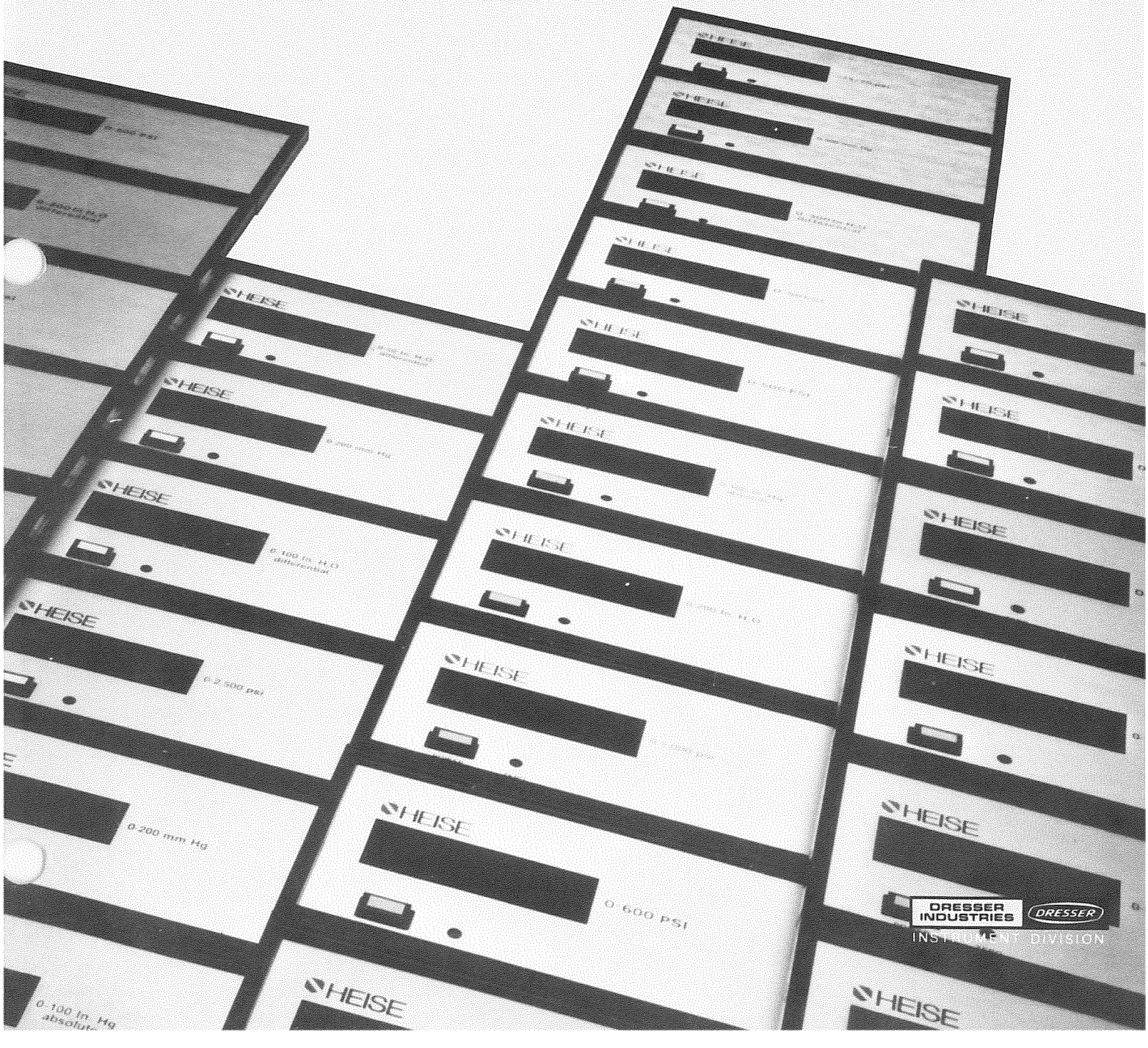
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HEISE®

Installation and Operating Instructions For Series 7 Digital Pressure Indicators

Models 710A and 710B Pressure Indicators
Models 711A and 711B Pressure Indicators
Model 712A Altitude/Pressure Indicator
Model 713B Barometer
Model 705BP Rechargeable Battery Pack



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1.0 PURPOSE AND SCOPE OF MANUAL

This manual is provided by Dresser Industries to give design and performance information and to guide users of all models of Heise Series 7 Digital Pressure Indicators. These Heise instruments are precision instruments, designed to measure and indicate pressure to a high degree of accuracy, yet rugged enough to provide instrument shop performance in field service. All parts have been designed or selected for such service and with proper care and maintenance will perform within specifications. For optimum performance, the instructions and procedures outlined in this manual should be followed for:

(1) Inspecting the equipment
(2) Routine operation
(3) Troubleshooting the unit
(4) Making repairs by replacement of parts

Most of the information and instructions in this manual apply to all models of Series 7 Pressure Indicators. When differing or additional information for a specific model number is required, it is so identified and given in a separate section.

The instructions in this manual are designed to be performed by qualified maintenance personnel.

IMPORTANT

The entire manual should be read thoroughly before using the instrument or attempting any service or repair. It should be kept with the instrument, or in a place of safe keeping, at all times, as it contains pertinent information for operation and maintenance.

If additional assistance is needed, contact Customer Service at:

Dresser Instrument Division
153 South Main Street
P.O. Box 515
Newtown, CT 06470
(203) 426-3115
Telex 643-481

Additional instruction manuals can be ordered through Customer Service.
Always include instrument model number and serial number in all correspondence to assure proper identification.

Dresser Industries does not recommend troubleshooting or repairs beyond the scope of this manual. Problems which cannot be remedied by following the instructions in this manual should be referred to the manufacturer. Immediate assistance can often be supplied by telephone. Defective components will be repaired or replaced by the manufacturer at his discretion and will be returned to the user by the same mode of shipment. Airmail and air express is recommended for urgent shipments. See Section 15.0 for Dresser's warranty. The form in Section 16.0 should be completed and accompany an instrument returned for repair.

2.0 SAFETY PRECAUTIONS

Electronic pressure instruments must be selected and used in accordance with recognized industry codes and safety practices to avoid the possibility of misuse or misapplication which could result in personal injury or property damage. Personnel responsible for selection and installation should also be familiar with the safety recommendations of ANSI B40.1, that apply to elastic pressure elements and their application in general and specific services. ANSI B40.1 is available from:

ANSI		ASME
1430 Broadway	OR	345 47th Street
New York, NY 10018		New York, NY 10017

1. **Pressure** — Select a range so that the maximum applied pressure will never exceed the upper range limit.
2. **Vibration** — Excessive vibration could cause loosening of components resulting in loss of instrument accuracy or failure to provide valid data.
3. **Pulsation** — Excessive pressure pulsation could result in fatigue failure of the pressure element.
4. **Temperature** — Operation of the instrument in an environment where temperatures are in excess of design ratings may result in loss of accuracy and failure.
5. **Process** — Pressure boundary materials must be resistant to the process media. Failure to assure compatibility may result in pressure sensing element deterioration or failure. Instruments used on high pressure gas, or potentially hazardous service, such as oxygen should be carefully selected in accordance with the recommenations of ANSI B40.
6. **Hazardous Location** — Only approved explosion proof or intrinsically safe instruments should be used in hazardous locations.
7. **Electro-Magnetic Interference** — Instruments should not be used in locations where EMI/RFI conditions exceed design ratings, to avoid erroneous performance.

2.1 WARNING

WARNING
THESE INSTRUMENTS ARE NOT EXPLOSION PROOF NOR INTRINSICALLY SAFE POWER LEVELS PRESENT PRECLUDE USE IN HAZARDOUS LOCATIONS

3.0 BASIC DESIGN—CONSTRUCTION

All Heise Series 7 Digital Pressure Indicators share the same basic design, utilizing the non-contacting optical sensor, microprocessor, PROMs, A/D converter and related software. Every component is readily accessible for inspection or servicing by simply removing the back or front plates and sliding the circuit boards out of the case. The main circuit board which slides into the lower track is identical for all ranges, except for the PROMs which are individually burned-in and programmed with the sensor at the time of calibration, minimizing any spare parts requirements. Accessory components and supplementary circuits to provide optional features or special application instruments are mounted on a circuit board which slides into the upper track and has a cable connected to the main circuit board. In most cases, optional features can be field installed with no effect on the calibration accuracy of the original unit.

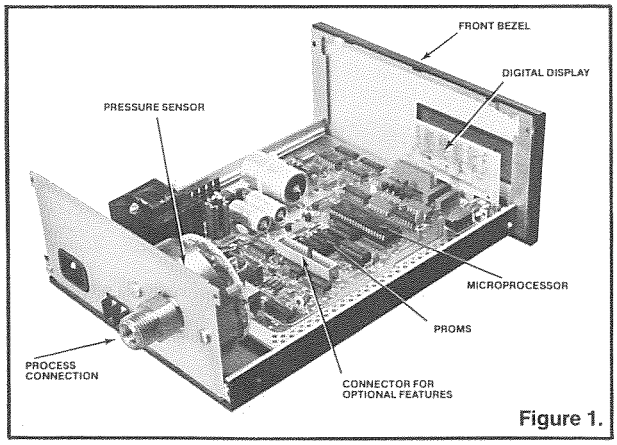


Figure 1.

3.1 Models 710A and 710B

The Heise Model 710 Digital Pressure Indicator is a highly accurate, compact and versatile pressure indicator. As standard, it can fulfill user needs for precision pressure measurement in general purpose applications. With selected options it can meet specific requirements.

Recognized for its accuracy, the Model 710A has a rated accuracy of better than ±0.1% of span. For more stringent requirements, Model 710B is supplied with accuracy of better than ±0.05% of span for all ranges except those where readability is limited by a four and one half digit display.

- Pressure ranges to 30,000 psi — See range selection chart in Section 6.1.
- Selection of output signals:
  Standard — ASCII serial, EIA RS-232-C compatible
  Optional — 4½ digit parallel BCD
  — 4-20 ma, 0-10v with BCD
  — "Hi"/"Lo" set point comparator with BCD and relay closures.

Note: All of the optional signals can be provided in the same instrument.

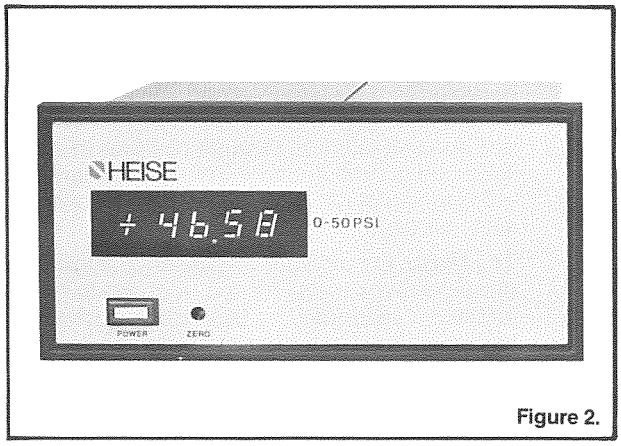


Figure 2.

Tracking Comparator

The Model 710 is available with an optional dual limit built-in tracking comparator. Bi-directional four and one-half digit thumb wheel switches, with polarity, permit readily adjustable settings of "Hi" and "Lo" limits for control alarm programming. The microprocessor compares digital data to the thumb wheel settings.

Three LED indicators signal "Hi", "Lo" or "In" status of the measured pressure. When either set point is reached, or the pressure is within operational limits, one of three form "C" relays is energized, in addition to the LED indicator. The relays are rated at 200 VDC, 0.5 amp resistance load, 10 watts maximum. (500 VDC, 1.5 amp, 20 watt rating available on application.) This feature eliminates the need for additional interfacing hardware.

An edge connector-hood assembly, providing convenient outlet for the relay signals or BCD output, is included with this option.

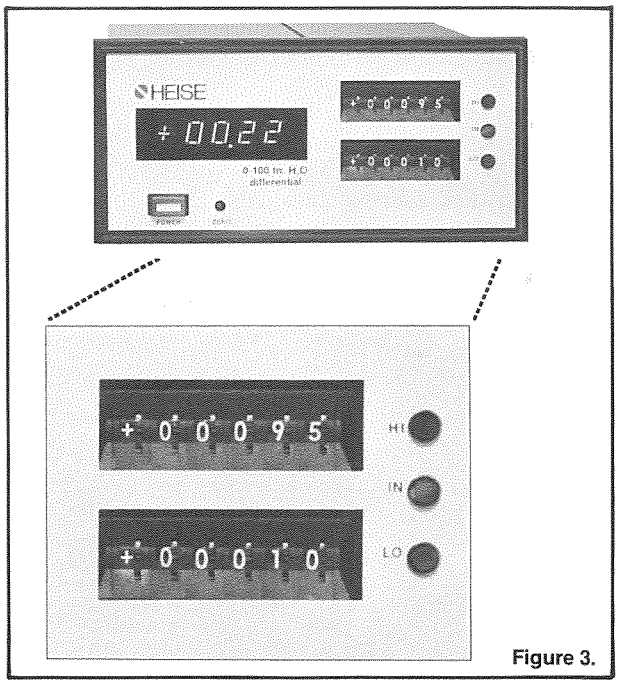


Figure 3.

DISCONTINUED

3.2 Models 711A and 711B

The Heise Model 711 Digital Pressure Indicator is a Model 710 modified with special options provided by a second microprocessor. It is designed to be capable of performing more than one specific function through changes in software. It has a full five digit front panel display with individual LEDs on the front panel to show system status.

The Model 711 provides display of your specific principal measuring unit and from one to four additional secondary units, through push button selection. The secondary units can be of any pressure proportional engineering units which have a linear mathematical relationship to the principal unit. Five digit parallel BCD is included.

A "Max-Trac" or "Min-Trac" optional feature enables the Model 711 to recall and display the highest (or lowest) value of pressure sensed during any pressure excursion, by the activation of a momentary switch. The system will continue to track the measured pressure and will update the display only when the current maximum (or minimum) value is exceeded. A second activation of the switch causes the measured pressure to again be displayed: however, maximum (or minimum) value data is continually being updated internally and will be retained in memory, from which it can be recalled and displayed at any time until the system has been cleared, or the power shut off.

Both "Max-Trac" and "Min-Trac" cannot be supplied on the same unit. It is only possible to track either the maximum or the minimum pressure with one instrument.

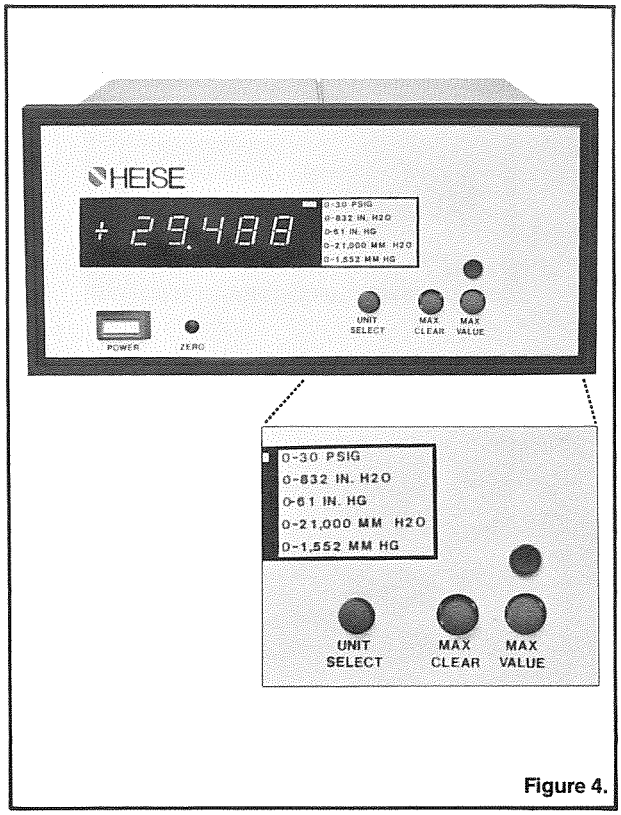


Figure 4.

3.3 Model 712A Altitude/Pressure Indicator

The Heise Model 712A Digital Altitude/Pressure Indicator is a dual function absolute pressure instrument that measures and displays pressure to an accuracy of better than ±0.05% of pressure span[1] The microprocessor controlled full five digit display provides high resolution and ease of reading for either absolute pressure or equivalent computed altitude, as selected through a front panel pushbutton. The altitude/pressure relationship for standard conditions, used in computations, is defined by the *U.S. Standard Atmosphere*, publication NOAA-S/T 76—1562, published in 1976.

DISCONTINUED

Specifications

Basic design and performance specifications for Model 712A are shown in the general specifications in section 5.0

Additional specifications include:

- Pressure Ranges: 0-36 inches Hg Absolute
  0-800 mm Hg Absolute
- Usable Altitude Ranges: -1400/100,000 feet
- Display: Full five-digit with .43 inch high LED, with F.S. readouts of 36,000 and 800.00
- Resolution: .002 inches Hg or .05mm Hg

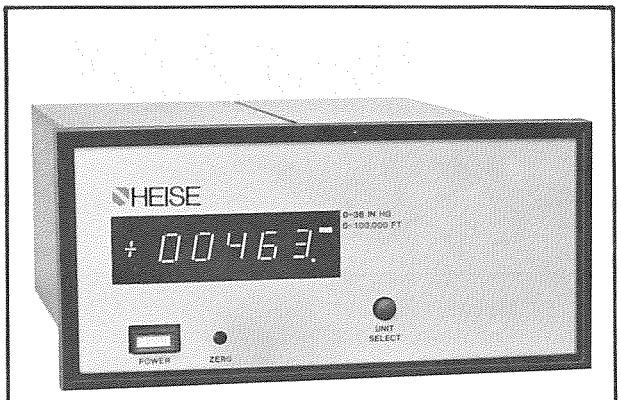


Figure 5.

(1) The accuracy of barometric pressure measurement is better than ±0.05% of span. The accuracy of altitude readout in feet will reflect the curve fit inaccuracy between pressure and altitude, as shown in Figure 6.

Accuracy of altitude readout in feet.
(For information on errors at other altitudes, contact factory)

ACTUAL ALTITUDE-FEET	MAXIMUM ERROR-FEET
— 1,400	18
0	17
5,000	22
10,000	27
15,000	29
20,000	38
25,000	45
30,000	45
35,000	56
40,000	69
45,000	91
50,000	110
55,000	143
60,000	209
65,000	242
70,000	308
75,000	389
80,000	492
85,000	614
90,000	775
95,000	984
100,000	1147

Figure 6.

DISCONTINUED

3.4 Model 713B Barometer

The Heise Model 713B Digital Barometer is an absolute pressure instrument that measures and displays barometric pressure to an accuracy of within ±0.03% of reading from 26" to 32" Hg. The microprocessor controlled full five digit display provides high resolution and ease of reading of barometric pressure in the range of 20" to 34" Hg, in any one of five equivalent engineering units, as selected. Automatic elevation compensation is dip switch programmable by the user to correct measured barometric pressure to sea level.

Temperature compensation from 60° F to 80° F minimizes temperature effect to ±0.003% of span/° F over temperature compensated span.

Specifications

Basic design and performance specifications for Model 713B are shown in the general specifications in Section 5.0.

Additional specifications include:

- Automatic Elevation Compensation — Dip switch programmable to correct to sea level, from -3500 to 10,700 feet. (See Section 10.5).
- Microprocessor controlled five digit display for high resolution and ease of reading of any five equivalent ranges:

Selectable Range	Resolution
1. 20 to 34 in Hg	0.001 in.
2. 508 to 863 mm Hg	0.01 mm
3. 9.82 to 16.69 psia	0.001 psia
4. 677 to 1151 mbar	0.1 mbar
5. 0.668 to 1.136 atm	0.0001 atm

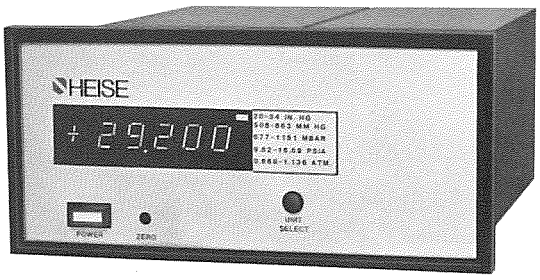


Figure 7.

3.5 Model 705BP Rechargeable Battery Pack

Heise Series 7 Pressure Indicators are available with rechargeable battery pack to provide a compact, convenient and completely portable unit for all types of pressure measurements where 115 VAC or 230 VAC supply is not available. The battery pack can also serve as a non-interruptable power supply.

The rechargeable battery pack, consisting of one 12 volt battery, recharging circuit, inverter and switching relay, will power the Series 7 for up to four hours of continuous operation. It can be recharged overnight from any 115 VAC (or optional 230 VAC) 50 or 60 Hz source. The circuit protects the batteries against excessive charge end also permits the Series 7 unit to be operated directly from 115 VAC (or 230 VAC) line voltage. The battery is recharging whenever AC power is applied.

Model 705 BP has a convenient carrying handle and is supplied with easily applied brackets for attachment to the indicator unit.

Battery packs are equipped with a light on the front plate to indicate when charging or low battery power. When the battery pack is disconnected from the AC power supply and is discharging through normal operation, the low power light will activate prior to having any low voltage effect upon the instrument being used. If the battery pack is not recharged at this time, the battery will continue to discharge causing the low battery indicator light and the pressure instrument to switch off.

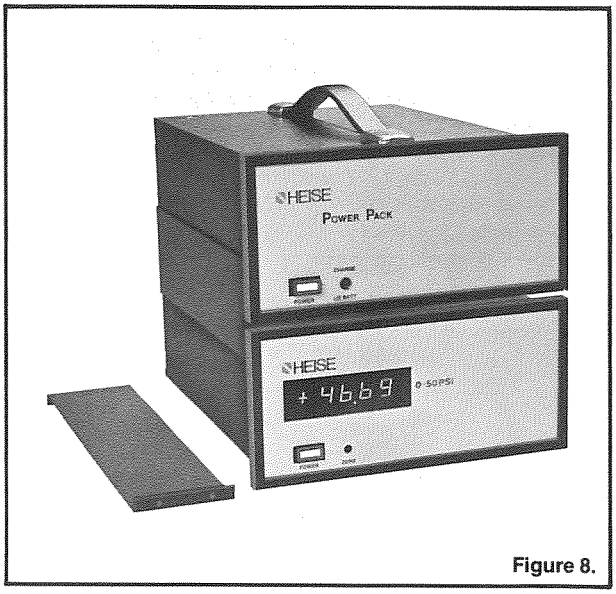


Figure 8.

TABLE I
Battery Power Pack Operating Time

Used with model number	Hours continuous operation
710A or 710B	4
711A or 711B	2
712A	2
713B	2

SPECIFICATIONS

Operating Time

Up to 4 hours. See Table I.

Note: Series 7 may also be powered by 115 VAC (or 230 VAC) through charging circuit for continuous operation.

Batteries

One 12 volt gel electrolyte, lead acid sealed (Globe Union Model GC 1245 gel/cell, or equal).

Battery Life

Up to 400 full charge/full discharge cycles.

Note: More cycles attainable if battery is not fully discharged.

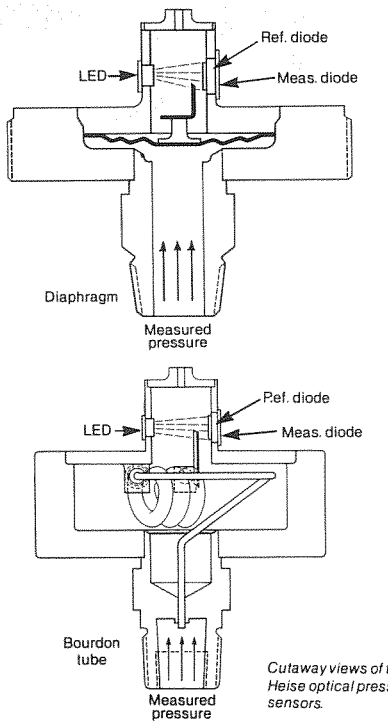
Temperature Operating Limits
-9° C to 66° C (15° F to 150° F)
Note: Series 7 will be functional to -9° C, but operating time will be considerably shortened (by approximately 50 percent), due to a decrease in battery capacity.

Voltage Requirement
115 VAC, 50 or 60 Hz (230 VAC optional)

Recharging/Time
Batteries are recharging whenever AC power is applied. Recharging time is 14 hours maximum, for fully discharged battery.
Note: Battery protected against excessive charge.

4.0 THEORY OF OPERATION

Heise Optical Pressure Sensor
The Heise Pressure Sensor incorporates an optical means of detecting the effective pressure on an elastic member, so there is no physical contact between the strained member, acted upon by pressure, and that portion which produces the electrical signal. This unique pressure sensor results in the extraordinarily accurate Heise Series 7 line of precision instruments. The Series 7 line is guaranteed to be accurate to 0.1 percent of span or better, and available as an option, an accuracy of 0.05 percent can be supplied for most ranges.



Cutaway views of the Heise optical pressure sensors.

Figure 9.

The fundamental operation of the sensor is quite simple. (see Figure 9) The diaphragm or small helical Bourdon tube element moves only 0.020 inches during a full span excursion, almost imperceptible to the eye.

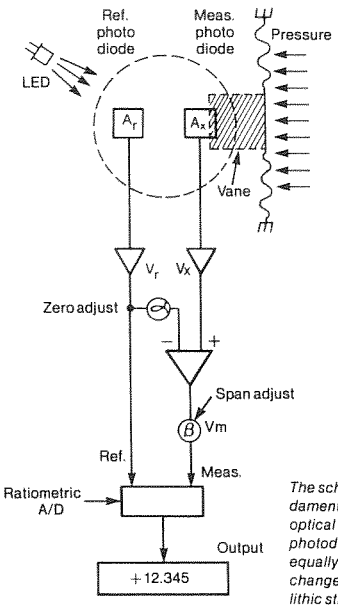
This small motion and the use of high strength materials result in minimum stress levels, well below metal yield points, to assure stability, repeatability, and long sensor life.

Fixed to the element is an opaque vane, a kind of miniature windowshade, which blocks near infrared light impinging on one of two monolithic photodiodes. The other photodiode continuously measures the intensity of the light source, an LED, and serves as a reference against which the measured light is compared. The near infrared wave length emission intensity produced by the LED is regulated by a simple feedback circuit using the output of the reference diode. See Figure 10.

Two voltage signals, V_r and V_x are generated by the reference and measuring photodiodes respectively. Letting k equal the photodiode light sensitivity factor, h the light intensity and A_r and A_x the respective diode areas, then

$$V_r = hkA_r \text{ and } V_x = hkA_x$$

Each signal by itself will vary with light intensity, h, and with the sensitivity factor, k. Ambient temperature can affect both h and k, but since a single light source is used, and the k for each diode is the same due to the monolithic structure, both V_r and V_x are affected by temperature in the same proportion.



The schematic shows the fundamental operation of the optical sensor. Since both photodiodes are affected equally by temperature changes, due to their monolithic structure, temperature drift of the sensor can be eliminated.

Figure 10.

A portion, $\propto$, of V_r is used to bias V_x to provide zero adjustment. The signal is then proportioned by a factor, β, representing a span adjustment. The resulting signals V_r and V_m are applied to a ratiometric, integrating type A/D convertor.

The output of the convertor is represented by:

$$\frac{V_x}{V_r} \quad \text{or } \beta \quad \left(\frac{A_x}{A_r} - \propto \right)$$

The ratiometric processing essentially eliminates any drift errors associated with the photodiodes and LED, and the output is a function of only the potentiometer settings $\propto$ and β and the ratio of the

exposed photodiode areas, A_x and A_r. Second order drifts in the amplifiers are compensated electronically and an autozero technique is used in the convertor.

The primary function of the microprocessor as the central control element is linearization of the measured pressure (Figure 11). During calibration, a pair of Programmable Read Only Memory devices (PROMs) are programmed to match the linearity characteristics of the pressure sensor. Digitizing occurs through a microprocessor controlled integrating type A/D converter.

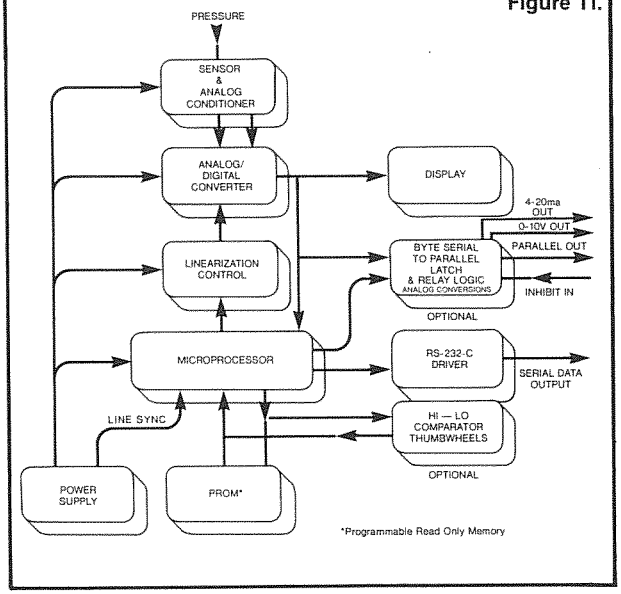
By using a digitally controlled, variable frequency clock, the analog/digital converter accumulates pulses during the integration of V_r in accordance with the look-up table resident in the PROMs. This technique causes frequency changes between zero and full scale. Up to 40 such changes are used to provide the segmental linearization. Each sensor is thus characterized by the PROMs which can be replaced if it is necessary to recalibrate or change the pressure sensor.

An auto-zero function in the analog/digital converter, synchronized to the line frequency for maximum normal mode rejection, minimizes thermally induced errors. The microprocessor also provides, as standard, output data in ASCII encoded format, electrically compatible with EIA RS-232-C.

Stability and Repeatability

The small motions of the pressure elements result in exceptionally long pulsation life and in almost negligible hysteresis, generally on the order of 0.02 percent of span or less, and repeatability of better than 0.005 percent of span.

Figure 11.



Gauge, absolute and differential pressures and vacuum can be measured by this single sensor.

To measure gauge pressure, the pressure is introduced to the sensor through the process connection and applied to the lower chamber side of the diaphragm. The upper, or reference, chamber above the diaphragm is vented to atmosphere.

Absolute pressure is measured in the same manner. However, the upper chamber is evacuated and sealed to provide a zero pressure reference for barometrically compensated absolute pressure measurements.

Differential pressure, to 100 psi maximum line pressure on the low pressure port, is measured by applying the higher, or upstream, pressure below the diaphragm, and the lower, or downstream, pressure above the diaphragm. The fluid introduced into the upper chamber above the diaphragm through the low pressure port must be clean, dry gas to avoid interference with the optical sensing.

Vacuum is measured by applying the vacuum to the lower chamber through the process connection and venting the upper chamber to atmosphere. Vacuum may also be measured using a dual port differential indicator by applying vacuum to the low pressure port and venting the lower chamber, through the process connection, to atmosphere.

5.0 SPECIFICATIONS
5.1 Standard Specifications

			MODEL NUMBER			
			710A 710B See Sec 3.1	711A 711B See Sec. 3.2	712A See Sec. 3.3	713B See Sec. 3.4
■ SENSOR:	Solid state non-contacting optical sensor measuring motion of a diaphragm or Bourdon tube pressure element, depending upon range		Diaphragm to 236 psi Bourdon tube for higher ranges		Diaphragm	
■ PRESSURE SENSOR MATERIAL:		Element	Inconel — 718. Optional 403 St. St. (410 St. St.) Consult Factory			
		Other Wetted Parts	316 st. st.			
■ PRESSURE MEDIA:			Any liquid or gas compatible with wetted parts materials (Note: For differential pressure indicator, low pressure port must use clean, dry, non-corrosive gas.)			
■ PROCESS CONNECTION:			1/4" NPT female/1/2" NPT male combination for ranges to 5000 psi. AUTOCLAVE F-250-C/AMINCO 45-11310 for ranges 6000 psi and higher			
■ RANGES:		Gauge Pressure —	0-50 inches water to 0-30,000 psi		—	—
		Absolute Pressure —	0-200 inches water to 0-30,000 psi		0-36" Hg A 0-800 mm HgA	20-34" Hg A
		Differential Pressure —	0-50 inches water to 0-100 psi		—	—
■ ACCURACY:	Percent of span including sensitivity, linearity, repeatability and hysteresis at 73°F (23°C) —		710A 711A Better than ±0.1%		Better than ±0.05%	Within ±0.03% of Reading from 26" to 32" Hg
			710B 711B Better than ±0.05%			
■ REPEATABILITY:			Better than ±0.005% of span			
■ SENSITIVITY:			Better than 0.005% of span			
■ DISPLAY:	Single plane, 0.43" high LED with decimal point and polarity —		4 1/2 digit For ranges with 20,000 or more counts, LSD is inactive	5 digit		
■ CONVERSION PERIOD:		Milliseconds maximum —	250 ms		Pressure Display 250 ms Altitude Display 800 ms	250 ms
■ WARM UP TIME:		For rated accuracy —	Less than 15 minutes			
		For complete stability —	Less than 30 minutes			
■ OPERATING TEMPERATURE RANGE:			25°F to 125°F (−4°C to 52°C)			
■ TEMPERATURE COMPENSATION:		Standard —	45°F to 95°F (7°C to 35°C)		60°F to 80°F (15°C to 27°C)	
		Optional —	25°F to 125°F (−4°C to 52°C)		—	
■ MAXIMUM TEMPERATURE EFFECT:		Percent of span per °F from reference temperature of 73°F (23°C)	±0.004% of span per °F over temperature compensated span		±0.003% of span per °F over temperature compensated span	
■ STORAGE TEMPERATURE:			−40°F to 180°F (−40°C to 82°C)			
■ OVERPRESSURE CAPABILITY:		Note: Calibration adjustment may be required after overpressure	100% of span to 500 psi 30% of span to 7,500 psi 20% of span to 10,000 psi 10% of span to 30,000 psi		100% of span	
■ OUTPUT SIGNALS:	See Section 6.0 for complete details	Standard —	Serial Output	—		
			—	B C D		
		Optional —	B C D	—		
			Hi-Lo Set Point Comparator with BCD and Relay Closures	—		
			4-20 ma and 0-10v with BCD	—		
■ POWER SUPPLY INPUT:			100/115/230 VAC nominal ±10%, 50/60 Hz			
■ POWER CONSUMPTION:		Watts Maximum	7	12		
■ RECHARGEABLE BATTERY PACK — MODEL 705BP			See Section 3.5			
■ HOUSING:			Black epoxy finished aluminum case with brushed aluminum front plate and black ABS plastic bezel			
■ MOUNTING:			Bench or panel. Portable with Model 705 BP rechargeable battery pack. (See Sections 3.5 and 14.0)			
■ DIMENSIONS:			See Section 14.0			
■ WEIGHT:		Pounds (Kilograms)	7.3 (3.3)	9 (4.1)		
NOTE: For additional specifications applying to specified model number only, refer to Section			—	3.2	3.3	3.4

TABLE II

6.0 STANDARD PRESSURE RANGES

6.1 Models 710 and 711 — Table III Gauge, Absolute and Differential Pressure Standard Ranges[1]

Models 710A and 711A — Standard — .10 percent of span accuracy — Available in all ranges

Models 710B — Optional — .05 percent of span accuracy — Available ranges shown in bold type

Model 711B — Optional — .05 percent of span accuracy — Available in all ranges

6.2 Model 712A

Refer to Section 3.3

6.3 Model 713B

Refer to Section 3.4

TABLE III

	psi	Inches Water	Inches Mercury	millimeters Mercury or Torr	Pascals	kg/cm² kp/cm² or bar	millibar or centimeters Water	millimeters Water
Differential Pressure Ranges[4] / Gauge Pressure Ranges / Absolute Pressure Ranges[3]	**2** 3 **5** **10** **15** **20** 30 **50** **60** **100**	**50** **100** **150** **200** 300 400 **500** **600** **1,000** **2,000** 3,000	**5** **10** **20** 30 32 36 **50** **60** **100** **200**	**100** **150** **200** 300 **500** **600** **760** **1,000** **1,500** **2,000** 3,000 **5,000**	kPa **20** 30 **50** **60** **100** **160** 250 400 **500** **600**	 **1.0** **1.6** 2.5 4.0 **5.0** **6.0**	**100** **200** 300 **500** **1,000** **2,000** 3,000 **5,000** **6,000**	**2,000** 3,000 **5,000** **10,000**
	150 **200** 300 **500** **600** **800** **1,000** **1,500** **2,000** 2,500 3,000 4,000 **5,000** **6,000** **10,000** **15,000** **20,000** 25,000 30,000		300	**6,000** **10,000**	**1,000** **1,600** 2,500 4,000 **6,000** **10,000** **16,000** MPa 25 40 **60** **100** **160** **200**	**10** **16** 25 40 **60** **100** **160** 250 400 **600** **1,000** **1,600** **2,000**	**10,000**	
VACUUM RANGES	**15**		**5** **10** **20** 30	**100** **200** 300 **500**	kPa **20** 30 **50** **100**	**0.1** **0.2** 0.3 **0.5** **1.0**	**1000**[2]	

(1) — Non standard ranges on application.

(2) — Available in millibar only.

(3) — Evacuated reference side for barometric compensation.

(4) — Reference side (low pressure port) must use clean, dry, non-corrosive gases. High pressure port can be used with any media compatible with 316 S.S. and Inconel -718. Maximum static working pressure for low pressure port is 100 psi.

Pressure	Vacuum	Pressure	Vacuum
10 psig	**−4.5 psig**	**10 In Hg**	**−4.5 In Hg**
15 psig	**−4.5 psig**	**15 In Hg**	**−4.5 In Hg**
20 psig	**−4.5 psig**	**20 In Hg**	**−4.5 In Hg**
30 psig	−5 psig	30 In Hg	−5 In Hg
50 psig	**−5 psig**	**50 In Hg**	**−5 In Hg**
60 psig	**−5 psig**	**60 In Hg**	**−5 In Hg**
100 psig	**−15 psig**	**100 In Hg**	**−30 In Hg**
150 psig	**−15 psig**	**150 In Hg**	**−30 In Hg**
200 psig	**−15 psig**	**200 In Hg**	**−30 In Hg**
300 psig	−15 psig	300 In Hg	−30 In Hg
		600 In Hg	**−30 In Hg**

With Model 711, selection between inches of mercury and psi can be accomplished.

TABLE IV

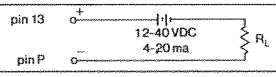
COMPOUND RANGES

The vane attached to the element of a Series 7 pressure sensor can be positioned to detect both positive and negative pressure changes, thus permitting limited compound ranges to be supplied. Compound ranges that can be furnished, as standard, are shown in Table IV. For other ranges, consult Newtown.

7.0 DATA OUTPUT SIGNALS

Heise Series 7 Pressure Indicators have standard and optional output signals for data transmission to computers or to controlling or recording instruments. Shown below are the available signals.

TABLE V

DATA OUTPUT SIGNALS		AVAILABLE WITH MODEL NUMBER	
		STANDARD	OPTIONAL[1]
Serial Output ASCII encoded 8-bit data plus one start and one stop bit Date rate: 1200 baud Interface: Two wire hookup, EIA RS-232-C Compatible. Two screw terminals located at rear of instrument. Viewing from the rear of the instrument, ground terminal is on left and data out terminal is on right. Data Sequence: Beginning of text, polarity, "1" bit (if applicable), MSD, D3, D2, LSD, end of text. Decimal position is not represented in data output.		710A 710B	Consult factory
BCD Parallel Output: (DTL/TTL Compatible) BCD 1-2-4-8 Coded, positive true. Drive Capability: 1 TTL unit load Logic one +2.4 VDC minimum Logic zero +0.4 V Sink for 1.6 ma. Inhibit input latches data for transmission during changes in input pressure. An external reading device should present a logic zero to the inhibit input upon finding a logic one signal present at the data ready pin. Latched data will be continuously valid until inhibit input is released. Continuous data sampling must allow inhibit input to be released for a minimum of 4 milliseconds during the absence of data ready. Data ready signal guarantees that BCD data is valid for 100 milliseconds of each conversion period. If data ready is sampled and found to be true by the presence of logic one, data will continue to be valid for a minimum of 10 milliseconds even though data ready may return to a logic zero state during this time.		711A 711B 712A 713B	710A 710B
Analog 4-20 ma and 0-10v with BCD			710A 710B
Tracking Comparator With BCD Output and External Alarm/Control Outputs	Dual limits with Bi-directional (positive and negative) 4½ digit "Hi" and "Lo" thumbwheel switches. LED Indicators for "Hi", "Lo" and "In". Three separate hermetically sealed form "C" relays rated 200 VDC, 0.5 AMP resistive load, 10 watts maximum. (Optional 500 VDC, 1.5 AMP resistive load, 20 watt rating)		710A 710B

(1) Edge connector with hood assembly supplied to handle all optional inputs/outputs.

7.1 Accessories

Edge connector with hood assembly to handle all optional inputs/outputs.

AMP Low Profile 44 Pin Connector — Part Number 2-53065-4

AMP Hood — Part Number 530087-4

AMP Keying Plug — Part Number 530687-1

8.0 EDGE CONNECTOR PIN IDENTIFICATION

MODEL 710
EDGE CONNECTOR OUTPUT-COMPARATOR, ANALOG AND/OR BCD OUTPUT (Arranged In Pin-Out Order)

Pin Number	Pin Letter
1 ± Sign	A "1" Digit
2 8 MSD	B 4 MSD
3 1 MSD	C 2 MSD
4 8 D3	D 4 D3
5 1 D3	E 2 D3
6 8 D2	F 4 D2
7 1 D2	H 2 D2
8 No connection	J 4 LSD
9 No connection	K 2 LSD
10 8 LSD	L 0-10 v, with pin Z
11 1 LSD	M Inhibit
12 Power Ground	N Power Ground
13 4-20 ma High	P 4-20 ma Low
14 Guard	R Guard
15 K_3-N/C Contact-Low Relay	S K_3-Common-Low Relay
16 K_3-N/O Contact-Low Relay	T K_2-Common-Low Relay
17 K_2-N/C Contact-In Relay	U K_1-Common-High Relay
18 K_2-N/O Contact-In Relay	V No Connection
19 K_1-N/C Contact-High Relay	W No Connection
20 K_1-N/O Contact-High Relay	X No Connection
21 Guard	Y Guard
22 Data Ready	Z High Q Ground

TABLE VI

MODEL 711 and 713
EDGE CONNECTOR BCD OUTPUT
(Arranged In Pin-Out Order)

Pin Number	Pin Letter
1 ± Sign	B 2 MSD
2 1 MSD	C 4 MSD
3 8 MSD	D 2 D4
4 1 D4	E 4 D4
5 8D4	F 2 D3
6 1 D3	H 4 D3
7 8 D3	J 2 D2
10 1 D2	K 4 D2
11 8 D2	M Inhibit
12 Power Ground	N Power Ground
13 +5 volts	P +5 volts
14 8 LSD	S 2 LSD
15 4 LSD	U LSD Decimal
16 1 LSD	V D2 Decimal
19 Max Value Bit	W D3 Decimal
20 4 Engineering Unit	X D4 Decimal
21 2 Engineering Unit	Y MSD Decimal
22 1 Engineering Unit	Z Data Ready

TABLE VIII

MODEL 712
EDGE CONNECTOR BCD OUTPUT
(Arranged In Pin-Out Order)

Pin Number	Pin Letter
1 ± Sign	B 2 MSD
2 1 MSD	C 4 MSD
3 8 MSD	D 2 D4
4 1 D4	E 4 D4
5 8D4	F 2 D3
6 1 D3	H 4 D3
7 8 D3	J 2 D2
10 1 D2	K 4 D2
11 8 D2	M Inhibit
12 Power Ground	N Power Ground
13 +5 volts	P +5 volts
14 8 LSD	S 2 LSD
15 4 LSD	U LSD Decimal
16 1 LSD	V D2 Decimal
	W D3 Decimal
19 Data Ready	X D4 Decimal
20 4 Engineering Unit	Y MSD Decimal
21 2 Engineering Unit	Z Sign Digit Decimal
22 1 Engineering Unit	

TABLE XI

MODEL 710
EDGE CONNECTOR-OUTPUT COMPARATOR AND/OR BCD OPTION (Arranged By Function)

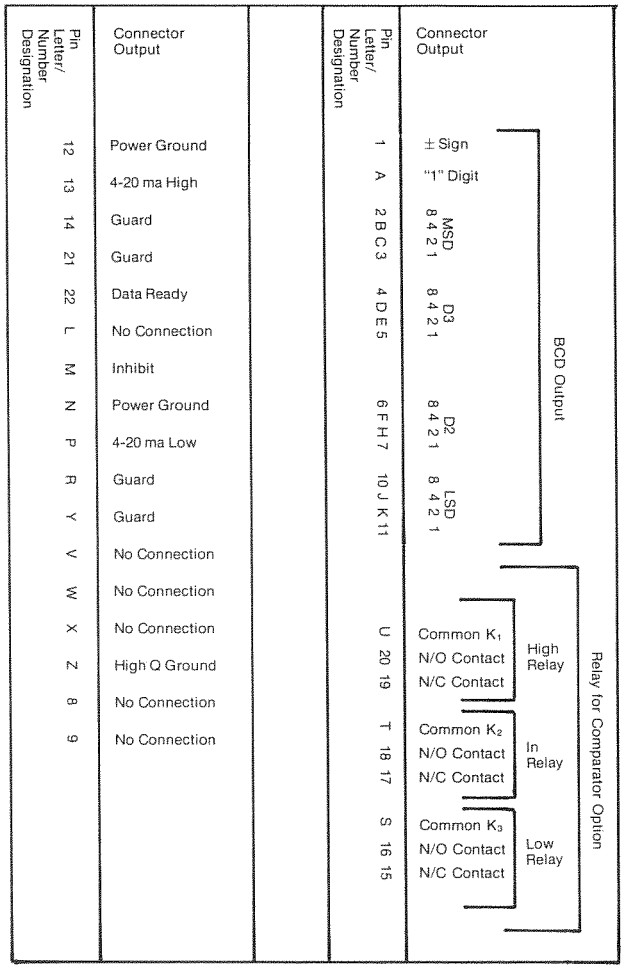


TABLE VII

9.0 INSTALLATION AND OPERATING INSTRUCTIONS

NOTE: These instructions apply to all models unless indicated otherwise.

9.1 Inspection

Remove unit from packing container and visually check for damage that may have occurred during transportation. If damaged consult factory for further instructions. In the absence of any apparent damage proceed as follows:

9.2 Power Up

Firmly press power cable receptacle over power input terminals located at rear of instrument. Connect power cable plug to suitable power supply. Nameplate on rear of instrument identifies the power requirements. Activate unit by depressing power switch located on front panel. At this time check display for any malfunction. If a malfunction is present consult troubleshooting guides located in Section 11.0.

In the absence of any malfunction disconnect power cable and proceed as follows:

9.3 Mounting

For bench model units apply stick-on feet to the base of the instrument using the template furnished with the mounting hardware as a guide. Reconnect power cable.

For panel mounting prepare an opening in the panel as outlined in Sect. 14.0 of this manual. Remove bezel by grasping top edge of bezel, lifting up gently and pulling towards front of the instrument. With the bezel removed and power cable disconnected slide the rear of the instrument into the opening. Secure the front flange to the panel with the four mounting screws provided. Snap bezel back over flange and reconnect power cable.

For portable battery operation apply stick-on feet to base of the pressure instrument using the template furnished with the mounting hardware as a guide.

Remove bezel from both battery pack and pressure instrument by grasping top edge of bezel, lifting up gently and pulling towards front of the unit. With the bezels removed, place the battery pack on top of the pressure instrument. On the rear of the battery pack, remove the lower two screws while removing the top two screws on the rear of the pressure instrument.

Mount the "Z" shaped bracket on each side of the unit, placing the front of the bracket (as marked) facing the front of the instrument. Utilizing the existing screws, attach the brackets to the rear of the battery pack and pressure instrument. Use the supplied nuts and screws to attach brackets to the front of the battery pack and pressure instrument.

Replace bezels.

Connect short cord from battery pack to receptacle of pressure instrument. The battery pack power switch must be in the "on" position to charge the battery pack and/or operate the unit.

Battery life expectancy is rated at 400 full charge/full discharge cycles with more cycles attainable if not fully discharged. Normal operating time is four hours or more.

Battery packs are equipped with a light on the front plate to indicate when charging or low battery power. When the battery pack is disconnected from the AC power supply and is discharging through normal operation, the low power light will activate prior to having any low voltage effect upon the instrument being used. If the battery pack is not recharged at this time, the battery will continue to discharge causing the low battery indicator light and the pressure instrument to switch off.

9.4 Pressure Input

9.4.1 Gauge and Absolute Pressure Ranges

Connect pressure line to the inlet port located at rear of the instrument. Standard inlet fitting for pressure ranges up to and including 5,000 psi is ½ inch NPT external thread with ¼ inch NPT internal thread. For pressure ranges 6,000 psi and above, an AMINCO 45-11310/AUTOCLAVE F-250-C fitting is standard. Reapply power cable and switch unit to "on" position.

Gauge pressure and vacuum — with zero pressure applied (connection open to atmosphere) adjust display to indicate all zeroes by rotating zero adjustment screw. Apply pressure to inlet and check all connections for leakage. In the absence of any leakage proceed with use. Exercise caution to assure unit is operated within the instruments rated range. **CAUTION — DO NOT ADJUST SPAN.**

Absolute pressure — To adjust zero on an absolute pressure range a vacuum must be applied to the instrument. The actual vacuum level required is a function of the instrument's pressure range. A vacuum of 25 microns or less is sufficient for zero adjusting of all absolute ranges. If this vacuum level is not achievable consult the manufacturer for the actual vacuum level required for your particular instrument.

Note: For Model 713B see Section 10.4.2.4.

9.4.2 Differential Pressure Ranges

Connect low pressure line to inlet port, identified as **"LOW PRESSURE CLEAN DRY GAS ONLY",** located on rear of instrument. Connect high pressure line to remaining inlet port. Standard inlet fittings are ½ inch NPT external thread with ¼ inch NPT internal thread. Reapply power cable and switch unit to "on" position. With both pressure lines open to atmosphere, adjust display to indicate all zeroes by rotating zero adjustment screw. Apply pressure to inlet ports and check all connections for leakage. In the absence of any leakage proceed with use. Exercise caution to assure unit is operated within the instruments rated range.

10.0 CALIBRATION

10.1 Calibration Specifications

NOTE: Calibration of Models 711, 712 and 713 is done in primary pressure range selection.

Standard calibration accuracy is better than ±0.1 percent of span, including sensitivity, linearity, repeatability and hysteresis at 73° F (23° C). Optional accuracy is better than ±0.05% of span.

Repeatability: Better than ±0.005 percent of span.

10.2 Factory Calibration

The factory calibration of a Heise Series 7 Digital Pressure Indicator includes three principal operations: temperature compensation, linearization and certification.

During temperature compensation each instrument is checked at three temperatures — the low end, the mid-span and the high end of the temperature compensation span. Resistance changes required to correct zero and span readings are determined for each temperature. These values are used to select temperature sensitive resistors which are installed in the circuit.

Linearization is achieved by comparing readings at specific pressure points to the pressure generated by a precise pressure standard. A special device simulating the PROM values is connected to the instrument and used to determine a linearity correction at each of the pressure points, effectively piece-wise correcting for linearity by a series of straight line segments in the A/D converter. After the instrument span is linearized within specifications, the values developed are permanently programmed into PROM chips which are installed in the finished instrument, after removal of the PROM simulator. Up to 40 linearization segments over the span are possible.

To certify the accuracy of the final product, the instrument is crossed checked against pressure standards which are traceable to the National Bureau of Standards. The accuracy of the pressure span is checked at 10 equal intervals, both upscale and downscale. Any deviation from the standard at each interval, is recorded and the information is forwarded to the customer as the "Calibration Certification Report".

After calibration each unit is given a final 96 hour burn-in before shipment.

10.3 Calibration Check Period:

Under normal usage it is recommended that the instrument be checked for calibration accuracy every three months or 2,000 hours.

10.4 Field Calibration

NOTE: Calibration checks of Models 711, 712 and 1713 should be done in primary pressure range selection.

10.4.1 Calibration Standards: A primary pressure standard with accuracy of 0.025 percent of reading or better is recommended to properly check or calibrate the displayed value. Corrections for local gravity effects, air buoyancy, and temperature should be applied to the pressure standard to compensate for environmental conditions.

Note: If a secondary transfer standard is used, it should be of the same range as the instrument being tested and have accuracy of 0.025 percent of span or better.

10.4.2 Calibration Procedures

Field calibration is limited to the setting of zero and span as all other adjustments have been permanently programmed into the unit and must not be altered. Zero and span adjustments are accessible from the front of the unit with a small tip screw driver. Connect power and suitable pressure standard to proper inputs and proceed with calibration as follows:

10.4.2.1 Zero Adjustment is accomplished with zero pressure applied to the pressure input. Rotate the zero adjustment potentiometer until the display indicates zero. See Sections 9.4.1 and 9.4.2 for details.

10.4.2.2 Span Adjustment

The span adjustment is behind the front panel which must be removed for access. To remove the front panel, grasp top edge of bezel, lift gently and pull toward front of instrument. With the instrument properly zeroed and using a suitable pressure standard, apply 100 percent of full pressure range of the indicator. Note the displayed reading. If the reading is less than the true value of the applied pressure, the span adjustment potentiometer must be turned clockwise to increase the display to the true value. If the reading is greater than the true value of the applied pressure, the span adjustment must be turned counterclockwise to decrease the display to the true value.

Note: After the span adjustment has been accomplished, recheck the zero indication. If there has

been a zero-shift, re-zero the instrument as described above and repeat the span check. Repeat zero and span adjustment if necessary.

10.4.2.3 Check for static pressure change effect on zero. (Differential Ranges Only)

With the instrument properly zeroed and spanned, apply equal pressure to both input ports in 10 percent increments. At each point record offset from zero, if any. Maximum pressure when applied equally to both input ports should not exceed 100 psig. Line pressures should be applied and released in controlled sequence so that the maximum differential pressure never exceeds 100 percent of the rated span.

Information obtained through the static pressure check may be used to further reduce instrument reading errors by applying the data as a correction factor.

10.4.2.4 Zero and Span Adjustment for Model 713B Barometer
The Model 713B Barometer is a suppressed scale absolute pressure instrument with a range of 20" to 34" Hg. Before making adjustments be certain that the rotary BCD switches are configured to a setting of 6500.

Apply 20" Hg absolute pressure and adjust the zero adjustment potentiometer to achieve a display of 20,000.

Apply 34" Hg absolute pressure and adjust the span adjustment potentiometer to achieve a display of 34,000.

Do NOT draw full vacuum and attempt to adjust the display to read 00,000.

10.5 Model 713B Correction To Sea Level
The Model 713B Digital Barometer is equipped with 4 user adjustable BCD switches to correct for atmospheric pressure variations resulting from operating the instrument at an elevation other than sea level. These switches are located behind the face plate on the left side of the upper printed circuit board, and are accessed by removing the bezel and face plate. (See Section 12.3.3.)

The switches are factory set to 6500. This setting provides zero elevation offset and the 713B responds as a normal absolute pressure indicator. The switches must be reset for the elevation at the installation site to have accurate barometric readings relative to sea level. After determining the installation site elevation in feet, consult the factory for the appropriate final switch settings. (See Section 1.0.).

10.6 Calibration of Optional Analog Output — Model 710

10.6.1 Voltage or current output is supplied by an addition to the optional BCD board. A printed circuit board with a Digital to Analog Converter (DAC) is attached to the BCD board, converting BCD data to either voltage or current signals. 0-10 volt output is supplied by the unit. 4-20 ma output requires an external power supply of 12-45 VDC.

10.6.2 Edge Connector
When analog output is specified, BCD output is also available from the same edge connector. Pin designations identify proper connections for BCD or analog output. For edge connector information, see Table VI in Section 8.0.

10.6.3 Calibration for 0-10 Volt Output (Pin L and Pin Z)
Refer to Figure 12 for adjustable potentiometer locations.

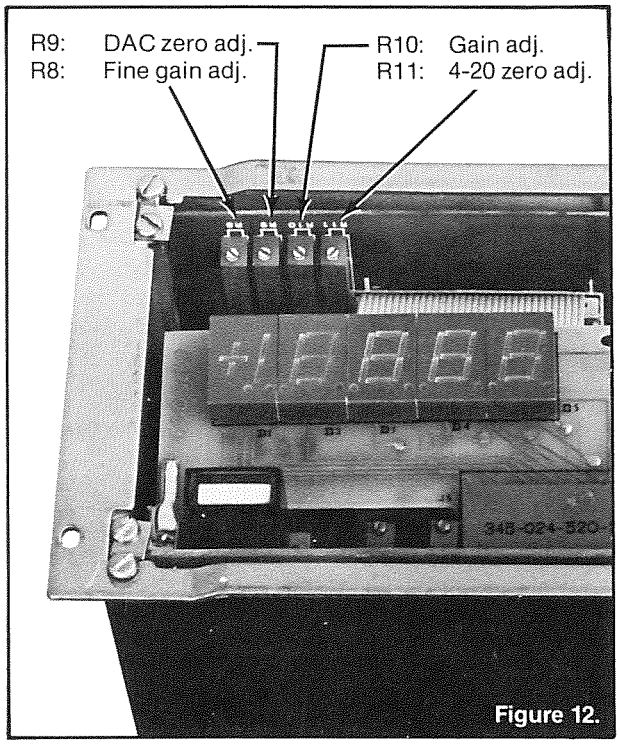


Figure 12.

Front View of Model 710
with bezel removed

1. Remove front bezel and plate assembly by grasping top edge of bezel and lifting up gently while pulling forward.
2. Connect a Digital Voltmeter, of proper accuracy and resolution, to Pin L (+) lead, and to Pin Z (-) lead.
3. Apply zero pressure to unit.
4. Pull pin M to ground (enabling inhibit signal).
5. Adjust pot R9 to zero output.
6. Release inhibit signal (pin M).
7. Apply 100% pressure.

   NOTE:
   For the purpose of D/A converter calibration, units normally displaying 10000 or 20000 counts, at full scale pressure, will use 9999 and 19999 counts, respectively, for full scale pressure display. The analog output drops to zero at 10000 or 20000 counts.

8. Pull pin M to ground (enabling inhibit signal).
9. Adjust pot R8 for 10 volts.

   NOTE:
   If R8 won't adjust to 10 volts, back R8 off to the middle of its range and use the output gain pot R10 to bring the output close to 10 volts. Now, R8 can be adjusted to 10 volts.

10. Repeat steps 1 through 8 to verify readings.
11. Replace front plate and bezel assembly.

10.6.4 Calibration for 4-20 ma Output (Pin 13 and Pin P)

Refer to Figure 12 for adjustable potentiometer locations.

1. Remove front bezel and plate assembly by grasping top edge of bezel and lifting up gently while pulling forward.
2. Place a 250 ohm resistor in series with the negative (-) lead of an external 12-45 volt D.C. supply.
3. Connect supply (+) lead to pin 13. Connect free end of above 250 ohm resistor to pin P.
4. Apply zero pressure to unit.
5. Pull pin M to ground (enabling inhibit signal).
6. Connect a Digital Voltmeter, with proper accuracy and resolution, across the 250 ohm resistor. Connect negative (-) lead to supply and positive (+) lead to pin P on edge connector.
7. Adjust R11 (See Figure 12) until voltmeter reads 1.000 volts across resistor.
8. Release inhibit signal (pin M).
9. Apply 100% pressure.

   NOTE:
   For the purpose of D/A converter calibration, units normally displaying 10000 or 20000 counts, at full scale pressure, will use 9999 and 19999 counts, respectively, for sull scale pressure display. The analog output drops to zero at 10000 or 20000 counts.

10. Pull pin M to ground (enabling inhibit signal).
11. Adjust R8 to obtain 5.000 volts on voltmeter. This corresponds to 20 ma loop current.

    NOTE:
    If R8 won't adjust to 5 volts, back R8 off to the middle of its range and use the output gain pot R10, to bring the output close to 5 volts. Now, R8 can be adjusted to 5 volts.

12. Repeat steps 1-9 to verify readings.
13. Replace front plate and bezel assembly.

11.0 TROUBLESHOOTING

11.1 General

Should a malfunction occur, this section may be used to identify possible causes.

11.2 Power Source

Failure of power will shut down the indicator; there will be no display on the indicator and no outputs. Check external switches and circuit protection devices. Check continuity of wiring from power source to power input at the rear of the indicator. Then check the condition of the fuse. The fuse is mounted on the main circuit board, located inside the case (3 AG, rated for 0.25 amp.).

11.3 Special Precautions for Circuit Board (PC) Assembly Repairs

11.3.1 Warning: Remove power cord before disassembly.

Mechanical Disassembly — Refer to Section 12.0

11.4 Troubleshooting Guide

TABLE X

Symptoms	Cause	Action
1. Display segments fail to light.	1. Loss of power.	1. Check power switch in "on" position. 2. Check power to rear. 3. Check fuse (inside unit)*
2. Most significant digit indicates plus "1". All others indicate blank except for decimal point.	1. Unit overranged. 2. Loss of communication between sensor and main board.	1. Return pressure to zero. 2. Switch power off, pause and turn power on. 3. Check ribbon cable connectors for pin contact with sockets on sensor and main board.*
3. Display segments light but fail to change value.	1. Loss of communication between sensor and main board. 2. Plugged pressure input port at rear of instrument.	1. Switch power off and switch power back on. a. Check ribbon cable connectors for pin contact with sockets on sensor and main board. 2. Clear all obstructions.*
4. Display segments light with random values.	1. Main board failure.	1. Return to factory.

NOTE: Units operating from battery packs should be tested with battery pack connected to suitable AC power supply and with battery pack power switch depressed to the "on" position.

* If the action checks fail to locate or rectify the cause of the symptoms, the unit should be returned to the factory for repair or replacement. See Section 16.0.

Mechanical Reassembly — Refer to Section 12.0

12.0 MECHANICAL DISASSEMBLY and REASSEMBLY

WARNING: LINE VOLTAGE IS PRESENT ON MAIN CIRCUIT BOARD

Remove power cord before disassembly.

Before troubleshootng, determine the most accessable approach to the instrument interior. Disassembly from the rear of the instrument is advantageous for troubleshooting the main PC board and sensor for all models. Front end access may be made to Model 710 when panel mounted.

For repairs to Models 711, 712 and 713 display boards or option circuit boards front end access is mandatory.

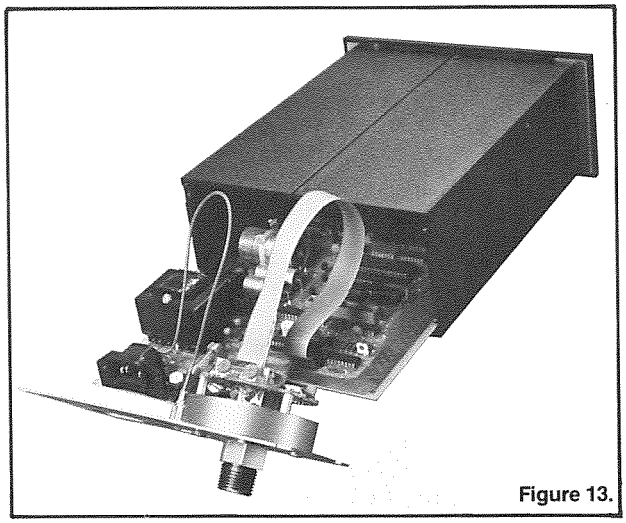


Figure 13.

12.1 Mechanical Disassembly From the Rear.

12.1.1 Remove screws from the four corners at the back of the case.

12.1.2 Remove rear panel with sensor attached. **Do NOT Disconnect ribbon cable from sensor or main PC board.** Then slide PC board out of the case. NOTE: FOR MODEL 710 EQUIPPED WITH OPTION BOARDS—SLIDE BOTH BOARDS OUT OF CASE SIMULTANEOUSLY.

12.1.3 Place PC assembly and rear panel on a non-conductive surface.

12.1.4 If a gross damage is noted on any component board, such as evidence of a burned or broken part, replace the board, or return it to the manufacturer for repair.

12.1.5 Note position of sensor, and ribbon cable, with respect to the main circuit assembly. The colored stripe or colored dot on the ribbon cable should be aligned next to the colored dot on the circuit assembly and sensor body. Improper connection of the ribbon cable could cause damage to the instrument.

12.1.6 Verify that all connectors and components are firmly seated in their respective sockets.

12.1.7 Apply power to the unit.

WARNING: LINE VOLTAGE IS PRESENT ON MAIN CIRCUIT BOARD

12.2 Mechanical Assembly From the Rear

Remove power cord before assembly.

After troubleshooting has been completed, assemble the instrument in the following sequence:

12.2.1 Slide the main board back into the case and secure backplate. If unit is equipped with an option board follow sections 12.2.1.1 through 12.2.1.5 prior to insertion of main board.

12.2.1.1 Insert front edge of main board approximately 1 inch inside the rear of the case.

12.2.1.2 Note the black arrow located on the ribbon cable connector that extends from the component side of the option board. This arrow signifies the connectors number one position. The main board is marked with a "1" at the number one position of the receptacle.

12.2.1.3 Hold the option board in a horizontal position behind the case with the component side down. Insert the flat edge of the board into the upper grooves of the case. Do not insert more than one half inch at this time.

NOTE: THE EDGE CONNECTOR FINGERS SHOULD BE LOCATED AT THE BACK OF THE BOARD. IF NOT, ROTATE THE BOARD 180° HORIZONTALLY.

Grasp the ribbon cable connector extending from the option board. Apply the connector to the receptacle located on the main board. DO NOT TWIST RIBBON CABLE. Confirm ribbon cable connector and main board number one pin positions agree.

12.2.1.4 Slide both boards into case simultaneously.

12.2.1.5 With both boards fully inserted replace backplate.

12.2.2 Connect power—Switch power "ON".

12.3 Mechanical Disassembly From the Front
Remove power cord before disassembly

12.3.1 For Model 710 without options circuit board.

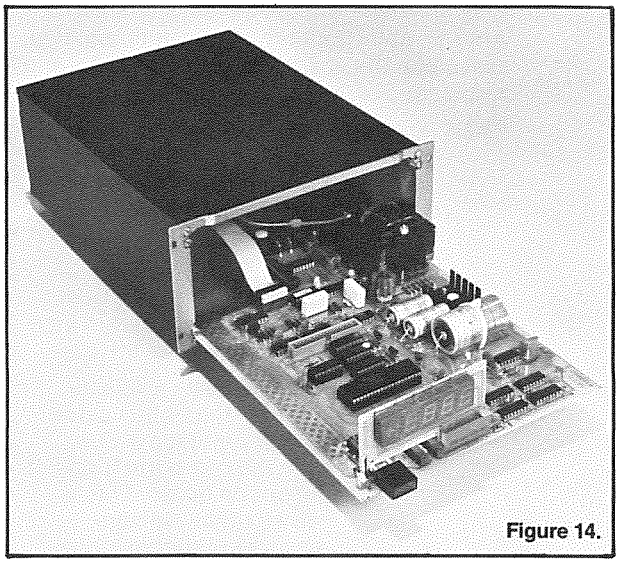


Figure 14.

12.3.1.1 Remove bezel by grasping top edge of bezel, lifting gently and pulling toward front of the instrument.

12.3.1.2 Loosen tab holding screws 2 or 3 turns to permit removal of tabs that hold circuit board in place. Tabs are slotted for easy removal and replacement.

12.3.1.3 Pull circuit board forward. (If there is clearance interference between the underside of the circuit board and the lower edge of the panel mounting bracket, loosen the four bracket screws and shift case upward to increase clearance and permit circuit board removal. Retighten bracket screws.) The ribbon cable connecting to the pressure sensor and the grounding wire are long enough to permit removal of the board.

12.3.1.4 If circuit board is to be tested with power on, place board on non-conductiong surface before connecting power cable.

12.3.1.5 For inspection or for parts or board replacement do not connect power cable. Disconnect pressure sensor ribbon cable from circuit board and disconnect grounding wire from lug connector on inside of rear panel.

12.3.1.6 If gross damage is noted on the circuit board, such as evidence of a burned or broken part, replace the board or return it to the manufacturer for repair (See Section 16.0).

12.3.1.7 If circuit board is replaced, the three PROMs must be removed from the original board and inserted in the same relative position in the new board, as these color coded PROMs are programmed to match the linearity characteristics of the instrument's pressure sensor.

Note: Proper orientation of the PROM in its corresponding socket can be determined by observing the small circular depression molded into the corner of the chip surface. This mark indicates pin #1. The #1 receptacle is indicated on the circuit board next to the socket. Proper matching will assure correct PROM installation.

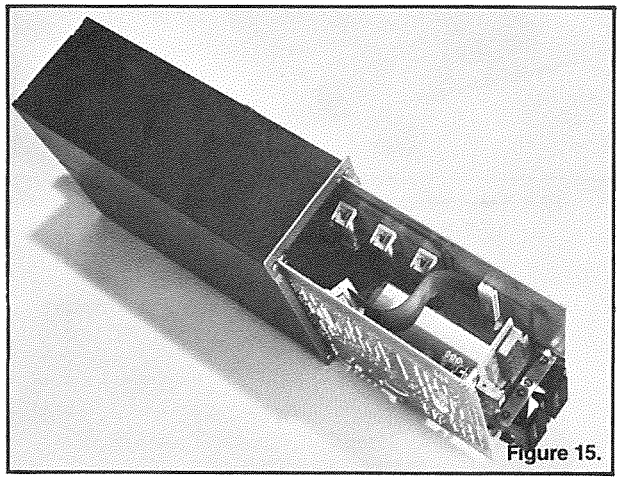


Figure 15.

12.3.2 For Model 710 with options circuit board.

12.3.2.1 Remove bezel and circuit boards stop tabs as in sections 12.3.1.1 and 12.3.1.2.

12.3.2.2 Pull both circuit boards forward simultaneously approximately 6". Placing the instrument on its side will facilitate simultaneous removal of both circuit boards.

12.3.2.3 Disconnect option board ribbon cable from connector on main circuit board and remove option circuit board.

12.3.2.4 Remove main circuit board and perform tests, inspection or replacements as in sections 12.3.1.3 through 12.3.1.7.

12.3.3 For Model 711, 712 and 713 Disassembly of these models differs from Model 710 in that the display board is part of the front panel assembly and is ribbon cable connected to the upper options circuit board. For easiest access, disassembly should be from both front and rear of the instrument; from the front to slide both circuit boards forward simultaneously and to disconnect power connector, and from the rear to disconnect pressure sensor ribbon cable from connector on main circuit board and grounding wire from lug connector on rear panel. Placing the instrument on its side will facilitate simultaneous removal of both circuit boards.

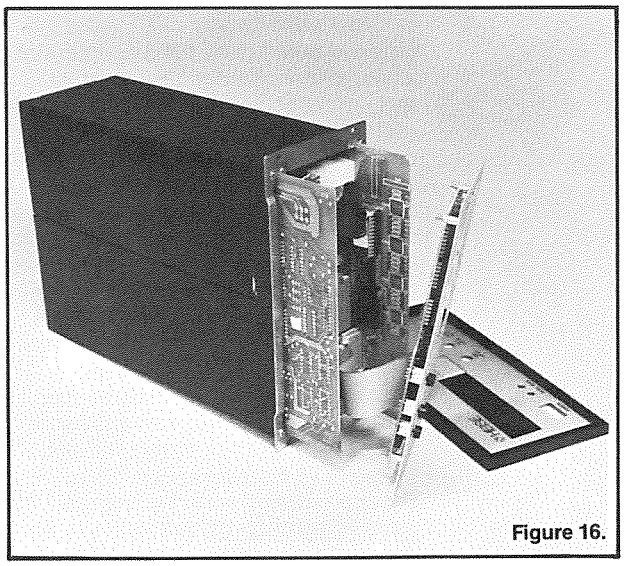


Figure 16.

12.3.3.1 Remove bezel by grasping top edge of bezel, lifting gently and pulling toward front of the instrument. The front panel-display board assembly will now be accessible. If desired to further test or inspect the display board it can be separated from the front panel by expanding the edges of the bezel. Note cable attached to options circuit board. **DO NOT REMOVE CABLE.** Removal of four small nuts on back of display board will permit removal of front panel from display board. Be careful not to jar display board; support it on a nonconducting surface while servicing.

12.3.3.2 Main circuit board and upper options circuit board should be removed simultaneously and serviced by following applicable instructions in Sections 12.1, 12.3.1 and 12.3.2.

12.3 Mechanical Assembly From the Front
Remove power cord before reassembly.

12.4.1 For Model 710 without options circuit board.

12.4.1.1 Reconnect grounding wire to lug connector on inside of rear panel.

12.4.1.2 Reconnect pressure sensor ribbon cable to main circuit board. Make certain that ribbon cable is not twisted and is properly connected as described in Section 12.1.5. Secure with holding clamp.

12.4.1.3 Insert flat edges of circuit board into lower grooves of case and push board into case.

12.4.1.4 Replace tabs that hold board in place and tighten screws.

12.4.1.5 Replace bezel by hooking lower edge of bezel under lower edge of panel bracket. Lift upper edge of bezel to expand sufficiently to permit pushing bezel over top edge of panel bracket and locking firmly in place.

12.4.2 For Model 710 with options circuit board.

12.4.2.1 Reconnect main circuit board grounding wire and pressure sensor ribbon cable as in Sections 12.4.1.1 and 12.4.1.2.

12.4.2.2 Insert flat edges of main circuit board into lower grooves of case and push board approximately 4" into case.

12.4.2.3 Insert options circuit board approximately 1" into upper grooves of case.

12.4.2.4 Reconnect options board ribbon cable to connector on main circuit board.

12.4.2.5 Push both circuit boards into case.

12.4.2.6 Replace holding tabs and bezel as in Sections 12.4.1.4 and 12.4.1.5.

12.4.3 For Model 711, 712 and 713 Review Section 12.3.3

12.4.3.1 Main circuit and options circuit boards should be inserted into case as per applicable instructions in Sections 12.2, 12.4.1 and 12.4.2.

12.4.3.2 If display board has been removed from front panel, re-

assemble and replace four small nuts to hold assembly together.

12.4.3.3 Insert front panel-display board assembly into bezel by expanding edges of bezel.

12.4.3.4 Replace bezel by following instructions in Section 12.4.1.5

13.0 FIELD REPAIRS — MODIFICATIONS

It is generally recommended that instruments be returned to the factory for major repairs or for modifications. While at the factory, instruments will also be thoroughly inspected. They can be updated if requested.

Qualified instrument maintenance personnel may elect to perform the following procedures.

13.1 PRESSURE SENSOR REPLACEMENT

In some instances, a range change may be desired or a sensor may have been damaged due to overpressure. This will require replacement of the pressure sensor. Field replacement can be accomplished without much difficulty by following these instructions.

13.1.1 Disconnect Power.

13.1.2 Remove main board following the procedure outlined in Section 12.1.

13.1.3 Remove ribbon cable connector retaining clip, located on the circular shaped analog board secured to the sensor. Note position of identification marks signifying number 1 pin position. Disconnect ribbon cable from analog board. If unit is equipped with option board, remove large ribbon cable connector extending from the component side of the main board. Set option board aside.

13.1.4 Using a 16 pin IC extractor remove PROM's identified as "U19", "U12" and "U13". Request main board assembly drawing 876D001 sheet 1 of 2 for exact PROM location.

13.1.5 Place new PROM's into their respective sockets. Order of placement and orientation within socket is determined by identification marks contained on the components. Appearing at the number 1 pin positions on the PROM's are either red,white or blue dots. Matching color dots are located at the number 1 pin positions of the sockets. Prior to insertion of a PROM, match the color dots and orient the PROM to assure proper pin position upon insertion.

WARNING: PRIOR TO INSERTION OF PROM, CHECK PINS FOR STRAIGHTNESS AND PROPER ALIGNMENT. FAILURE TO ASSURE PROPER PIN INSERTION MAY RESULT IN DISPLAYING ERRONEOUS DATA.

13.1.6 Connect ground wire, ribbon cable and retaining clip to the replacement sensor and backplate assembly. The ribbon cable pin connector has a red dot marking the number 1 pin position. The socket located on the sensor's analog board has one corner trimmed at a 45° angle and a red dot signifying its number one pin position. Prior to insertion of ribbon cable connector, orient connector and socket to assure proper pin position upon insertion.

WARNING: IMPROPER PIN ORIENTATION OF RIBBON CABLE CONNECTOR MAY CAUSE PERMANENT DAMAGE TO THE ANALOG BOARD.

Decimal point location is fixed at the time of assembly by the placement of a pin jumper. If the pressure range has remained the same during sensor replacement proceed to Sec. 13.1.9 omitting Secs. 13.1.7 and 13.1.8. If the pressure range has been changed consult Table XI to determine if the decimal position requires a change in location. With Table XI note the current decimal location by segment that corresponds to the range of the sensor just removed. Then note the decimal location by segment that corresponds to the range of the sensor being installed. If decimal location is the same for both sensors, proceed to Sec. 13.1.8 omitting Sec. 13.1.7. If decimal location must be changed, proceed through the following steps. (Note - This applies to Model 710 display only.)

13.1.7 Located directly in back of the display board connector is an eight-pin header "PS-1". (See Figure 17). With this header is a blue "mini-jump" connector. Viewing from the front of the display the decimal point location is changed as follows:

First pair of parallel terminals on right places the decimal point in front of the least significant digit.

Placing the jumper to the extreme left position places the decimal to the right of the most significant digit on the display. Each pair of parallel terminals represents one position. From Table XI determine the proper decimal location that corresponds to the range of the sensor being installed. The right hand column illustrates the required jumper position for the corresponding range shown in the left hand column. Move the jumper to the appropriate position. Ranges without a decimal do not require a jumper to be present.

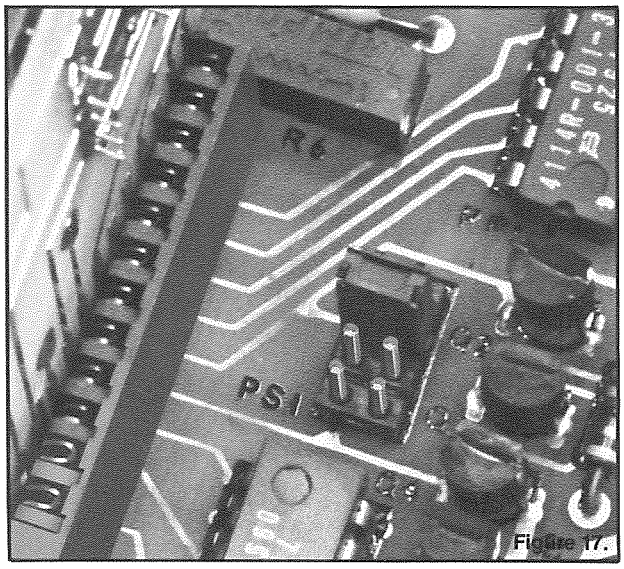


Figure 17.

13.1.8 Remove front bezel assembly by grasping the top edge of the bezel, lifting up gently and pulling toward front of the instrument. Remove front plate from bezel by gently expanding top and bottom edges of bezel. Insert new front plate with range legend that corresponds to the range of the newly installed sensor. Replace front bezel assembly.

13.1.9 Slide the main board back into the case and secure backplate. If unit is equipped with an option board follow Sec. 13.1.9.1 through Sec. 13.1.9.6 prior to insertion of main board.

13.1.9.1 Insert front edge of main board approximately 1 inch inside the rear of the case.

13.1.9.2 Note the black arrow located on the ribbon cable connector that extends from the component side of the option board. This arrow signifies the connectors number one position. The main board is marked with a "1" at the number one position of the receptacle.

13.1.9.3 Hold the option board in a horizontal position behind the case with the component side down. Insert the flat edge of the board into the upper grooves of the case. Do not insert more than one half inch at this time.

NOTE: THE EDGE CONNECTOR FINGERS SHOULD BE LOCATED AT THE BACK OF THE BOARD. IF NOT, ROTATE THE BOARD 180° HORIZONTALLY.

13.1.9.4 Grasp the ribbon cable connector extending from the option board. Apply the connector to the receptacle located on the main board. DO NOT TWIST RIBBON CABLE. Confirm ribbon cable connector and main board number one pin positions agree.

13.1.9.5 Slide both boards into case simultaneously.

13.1.9.6 With both boards fully inserted replace backplate.

Connect power—Switch power "ON"—reset zero and span as outlined in Section 10.4.2.

TABLE XI

Models 710A and 710B

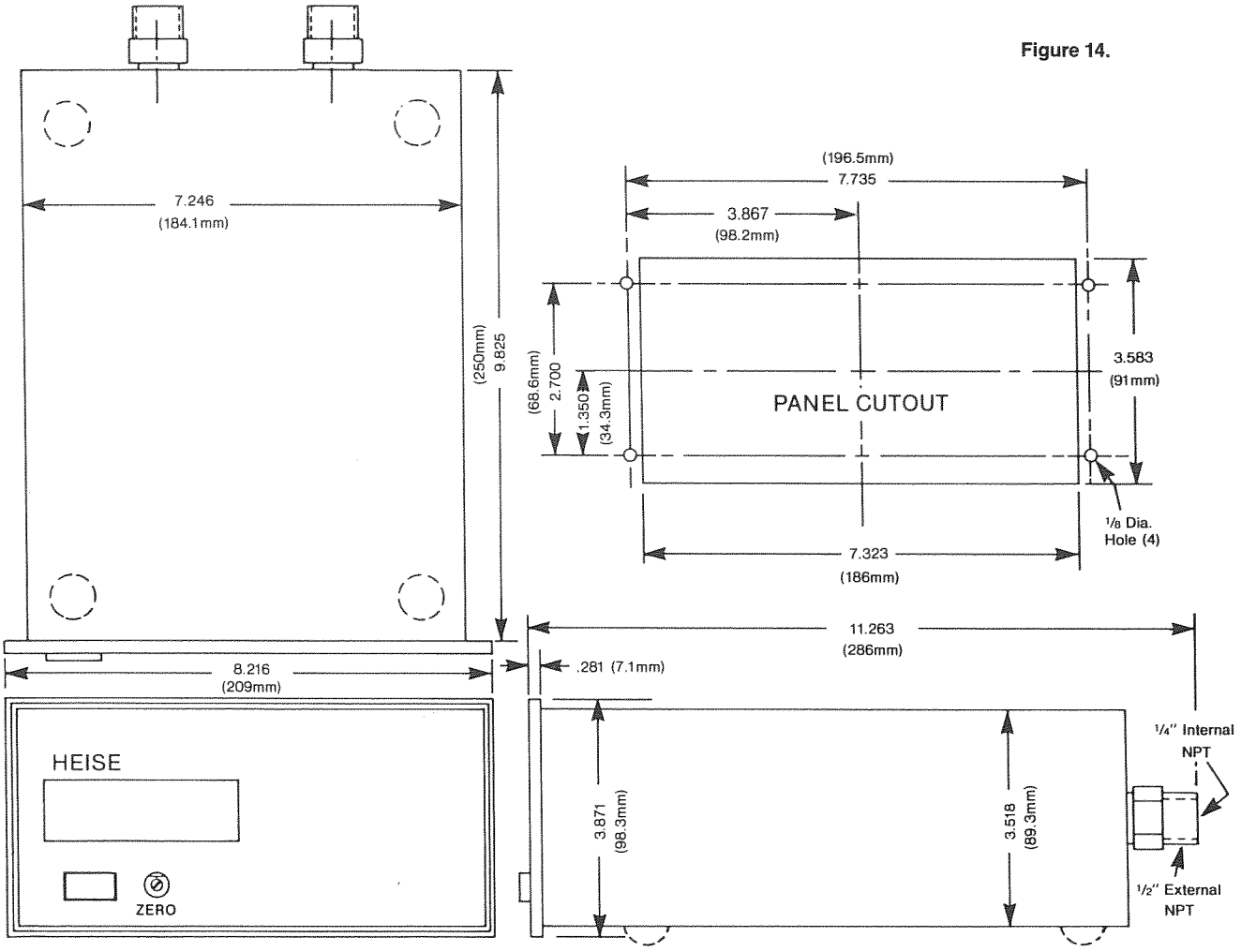
Range*	DISPLAY					PS-1 Jumper Position
1	1.	0	0	0	0	
1.6	1.	6	0	0	0	
2	1.	9	9	9	9	
2.5		2.	5	0	0	
3		3.	0	0	0	
4		4.	0	0	0	
5		5.	0	0	0	
6		6.	0	0	0	
10	1	0.	0	0	0	
15	1	5.	0	0	0	
16	1	6.	0	0	0	
20	1	9.	9	9	9	
25		2	5.	0	0	
30		3	0.	0	0	
32		3	2.	0	0	
36		3	6.	0	0	
40		4	0.	0	0	
50		5	0.	0	0	
60		6	0.	0	0	
100	1	0	0.	0	0	
150	1	5	0.	0	0	
160	1	6	0.	0	0	
200	1	9	9.	9	9	
250		2	5	0.	0	
300		3	0	0.	0	
400		4	0	0.	0	
500		5	0	0.	0	
600		6	0	0.	0	
800		8	0	0.	0	
1000	1	0	0	0.	0	
1500	1	5	0	0.	0	
1600	1	6	0	0.	0	
2000	1	9	9	9.	9	
2500		2	5	0	0	No Jumper
3000		3	0	0	0	No Jumper
4000		4	0	0	0	No Jumper
5000		5	0	0	0	No Jumper
6000		6	0	0	0	No Jumper
10000	1	0	0	0	0	No Jumper
15000	1	5	0	0	0	No Jumper
20000	1	9	9	9	9	No Jumper
25000**		2	5	0	0	No Jumper
30000**		3	0	0	0	No Jumper
50000**		5	0	0	0	No Jumper
60000**		6	0	0	0	No Jumper

*All Engineering Units
**Front Plate Labeled "X10" Beside Readout.

Decimal point location for Models 711, 712 and 713 is software controlled and cannot be changed in field.

14.0 DIMENSIONAL INSTALLATION DIAGRAM

Figure 14.



Housing and panel cutout dimensions shown apply to all indicator models and rechargeable battery pack.

WEIGHTS

MODEL NUMBER	POUNDS	KILOGRAMS
710	7.3	3.3
711, 712, 713	9	4.1
705BP	10.5	4.8
FOR SHIPPING WEIGHT ADD	3	1.4

TABLE XII

15.0 WARRANTY AND LIMITATION OF LIABILITY

All Heise Products and Parts carry a warranty against defective material and workmanship for a period of one (1) year from date of shipment.

A complete warranty and limitation of liability statement is made on the standard quotation form at the time of sale.

16.0 SHIPPING INSTRUCTIONS FOR RETURN TO FACTORY

Pack securely to prevent possible damage in shipment.

SHIP TO: Dresser Industries, Inc.
Instrument Division
153 South Main Street
P.O. Box 515
Newtown, CT 06470

Attention: Service Section

Furnish the following information with return of instrument.

SHIPPING INSTRUCTIONS

Company Name _____

Phone Number _____

Person to Contact _____

Address _____

_____

Model _____

Serial Number _____

Symptoms _____

_____

_____

_____

17.0 SCHEMATIC AND ASSEMBLY DRAWINGS

17.1 Final Assembly Drawings

As this manual applies to seven model numbers, with various options, only the final assembly drawing for each model number, for basic component identification, is included.

TABLE XIII

Model Number	Final Assembly Drawing Number
710A 710B	800D001
711A 711B 712A 713B	800D010
705BP	800D008

17.2 Circuit Board Schematic and Assembly Drawings

Latest revisions of circuit board schematic and assembly drawings, reflecting current designs for all model numbers, are available upon request to Customer Service. (See Section 1.0). Drawing numbers are identified in Table XIV.

17.2 SCHEMATIC AND ASSEMBLY DRAWINGS

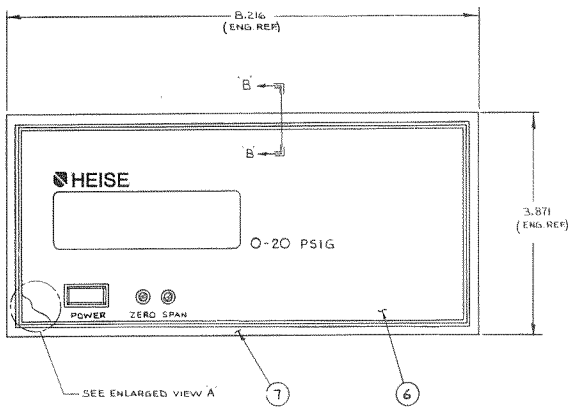
TABLE XIV

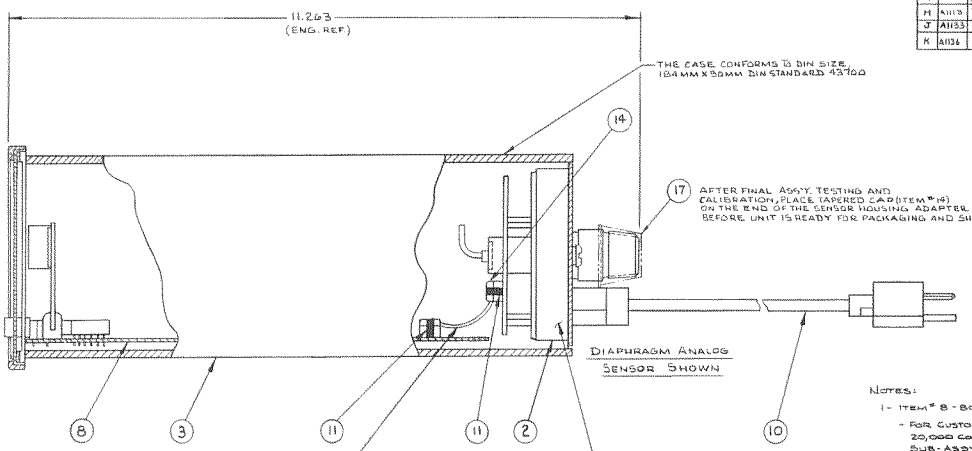
Model No.	Circuit Board Description	Schematic Drawing No.	Assembly and Parts List Drawing No.
710A 710B	Sensor Analog	839C015	876C002
	Main	839R001	876D001
	Display — Std. 4½ Digit	Part of 839R001	876C003
	— Opt. 5½ Digit for Ranges Over 20,000	839D020	876C022
	Secondary — BCD Output	839R002	876D004
	— BCD/Analog Output	839R002	876D004
	— BCD/Comparator	839R002	876D004
	— Thumbwheel	Part of 839R002	876C005
	— Analog Output (D/A)	839C021	876C023
711A 711B	Sensor Analog	839C015	876C002
	Main	839R001	876D001
	Display — 5½ Digit	839D012	876D014
	Secondary	839R013	876D015
712A	Sensor Analog	839C015	876C002
	Main	839R001	876D001
	Display	839D012	876D014
	Secondary	839R013	876D015
713B	Sensor Analog	839C015	876C002
	Main	839R001	876D001
	Display	839D012	876D014
	Secondary	839R013	876D015
705BP 110VAC	Main	839D003	876D006
705BP 220VAC	Main	839D003	876D006

SHEET 1 OF 5

800D001

REVISIONS				
LTR	ECN	DESCRIPTION	BY	DATE
D	A1077	B/M REDRAW & RENUMBERED	PW	4-7-77
E	A1080	SEE ECN	PW	10-19-77
F	A1107	ADDED SHT 9, REL'S -12 & -13 SEE ECN FOR OTHER CHANGES	PW	4-18-78
G	A1109	REVISED ITEM # 8 PER ECN, ADDED NOTE 1 ON SHT 1 & 5 SEE ECN	PW	6-1-78
H	A1113	ADDED ALT'S ITEM # 8 PER ECN INCORRECT ED 880D005-AK	PW	9-11-78
J	A1133	SEE ECN	PW	1-16-79
K	A1136	REVISED -11, -12 & -13 ASSYS.	PW	1-17-79



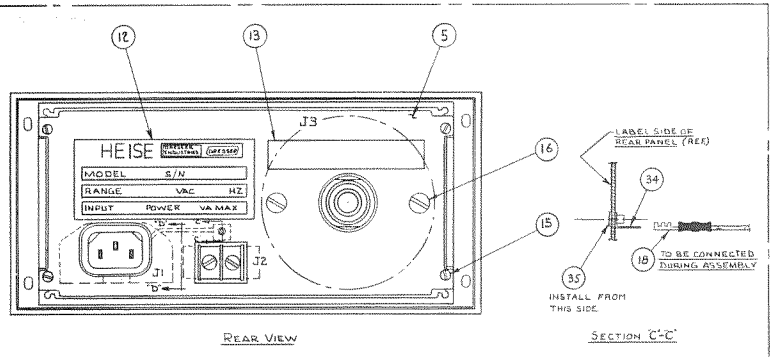


NOTES:

1 - ITEM # 8 - 800D001 -01 THRU -08

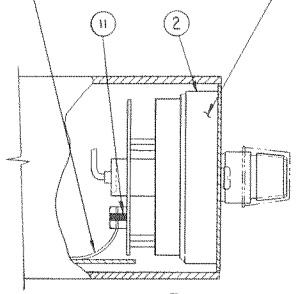
- FOR CUSTOMER ORDERS UP TO & INCLUDING 20,000 COUNT RANGES, USE MAIN BD SUB-ASSY # 880D004-01 (4½ DIGIT DISPLAY)
- FOR HIGHER COUNT RANGES, USE MAIN BD SUB-ASSY # 880D004-02 (5½ DIGIT DISPLAY)

2 - APPLY RTV ADHESIVE TO ALL SOCKTED COMPONENTS AND CONNECTOR ASSYS. THAT AREN'T RETAINED TO SOCKET.

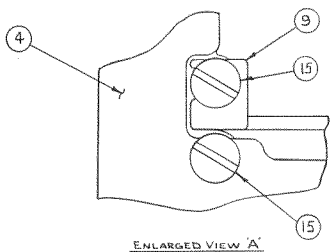


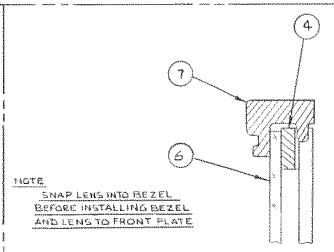
PLUG IN CONNECTOR ASSY (ITEM # 21) FIRST TO POWER BD. THEN PLUG OTHER END OF CONNECTOR ASSY. TO ANALOG SENSOR BOARD. THEN ADD (2) DIP LOCK FASTENER (ITEM # 17)

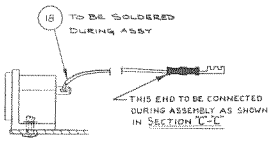
WHEN MOUNTING SYSTEM TO REAR PANEL THE CONNECTOR FOR CONNECTOR ASSY. SHOULD BE LOCATED TOWARDS BOTTOM OF PANEL.



	35	1	859A021-02	POP RIVET			
	34	1	836A009-01	TAB			
(NOT SHOWN)	20	1	856B001-01	PACKAGING	–	–	856B001
(NOT SHOWN)	19	1	856A003-01	MOUNTING KIT	–	–	856A003
	18	1	828B013-01	RECPT, WIRE, TERM. ASSY			828B013
	17	1	862A002-01	PLASTIC CAP	PLASTIC	–	862A002
	16	2	854A006-04	SCREW, PAN HD, 10-32 x 5/16 LG	"	–	854A006
	15	10	854A004-07	SCREW, PAN HD # 4-40 x 1/2 LG	"	–	854A004
	14	1	828B009-01	CONNECTOR ASSY	–	–	828B009
	13	1	857A003-01	LABEL, PROD. LIABILITY	MYLAR	–	857A003
	12	1	857A001-01	LABEL, MODEL 710A	ALUM	MATTE	857A001
	11	2	836A006-01	DIP LOCK FASTENER	–	–	836A006
	10	1	836A001-01	POWER CORD	–	–	836A001
	9	2	859A001-01	STOP TAB	STL	YELLOW ZINC CHRO	859A001
SEE NOTE 1 (THIS SHEET)	8	1	880D004-01 02	MAIN P/C BD. SUB ASSY.	–	–	
	7	1	863D001-01	BEZEL	A.B.S	LT MATTE	863D001
	6	1	859C005-03	LENS ASSEMBLY	ALUM	ALUMINITE 204 A1	859C005
	5	1	859D006-01	REAR PANEL PLATE	–	–	
	4	1	859D007-01	FRONT PANEL PLATE	STL	YELLOW ZINC CHRO	859D007
	3	1	864D008-01	CASE	EXTRUDED	PAINT BSL WHITE	864D008
				ANALOG SENSOR ASSEMBLY	PER CUSTOMER ORDER SELECT FROM TABLE 875D002		
	1	–	800D001-01	MODEL 710A BASIC	–	–	–
	ITEM NO.		PART NO.	DESCRIPTION	MATERIAL	FINISH	DWG. NO.







MODEL 710A
FINAL ASSEMBLY
BASIC MODEL

DRESSER
INDUSTRIAL VALVE & INSTRUMENT DIVISION
BARTONVILLE, CONNECTICUT 06013

DRAWN B.T. DATE 5-26-79
CHK'D DATE
APPROVED DATE RELEASED 6-14-79

SCALE 1:1

800D001 REV K

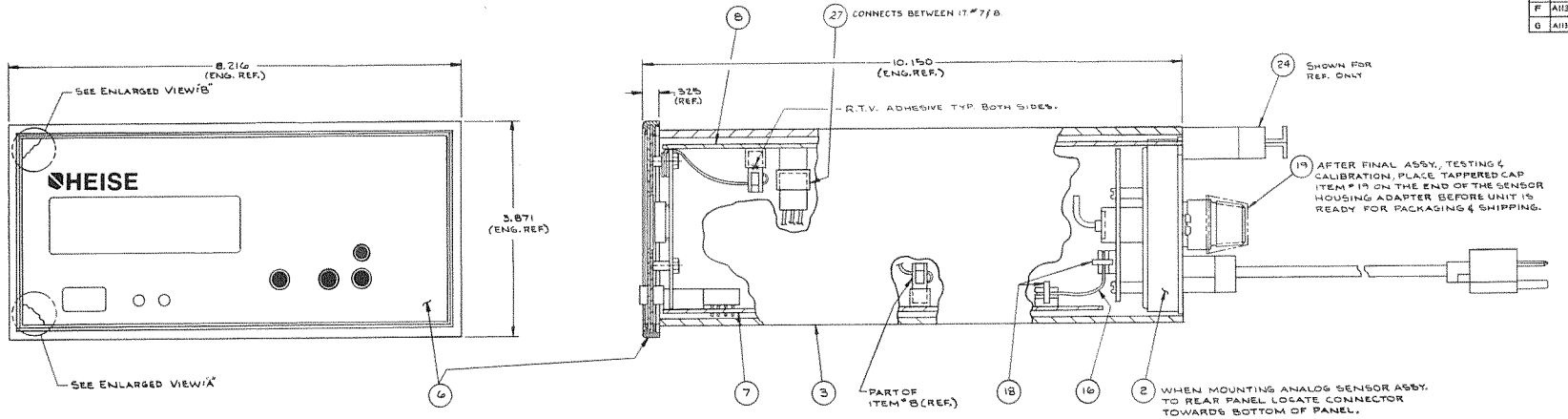
SHEET 1 OF 5

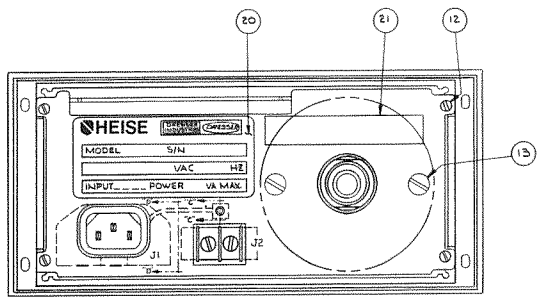
0100008

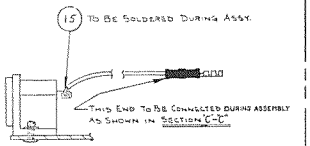
CONFIDENTIAL

This drawing embodies confidential information of the Industrial Valve and Instrument Division of Dresser Industries, Inc. and is the property of Dresser and/or its subsidiaries and affiliates. Dresser has loaned this copy with the understanding that it will not be reproduced, (b) it will not be used for any purpose except that for which it is loaned, and (c) it will be returned on demand.

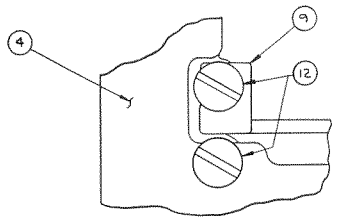
REVISIONS				
REV LTR	CIN NO.	DESCRIPTION	BY	DATE
A	A1008	RELEASED	[illegible]	[illegible]
B	A1080	SEE ECN	[illegible]	[illegible]
C	A1096	OBSOLETED 045-051-05 (UNRELEASED) RELEASED NEW-03, -04 & -06	[illegible]	[illegible]
D	A1123	SEE ECN	[illegible]	[illegible]
E	A1126	RELEASED -07 / -08 ASSYS.	[illegible]	[illegible]
F	A1139	SEE ECN	[illegible]	[illegible]
G	A1139	ADDED ITEM #27	[illegible]	[illegible]



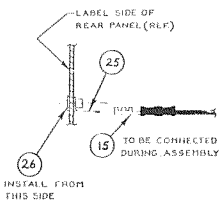




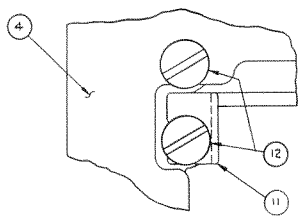
SECTION "D-D"



VIEW: "A"
SCALE 4:1



SECTION: "C-C"



VIEW: "B"
SCALE 4:1

NOTES:
1. APPLY R.T.V. ADHESIVE TO ALL SOCKETED COMPONENTS & CONNECTOR ASS'YS. NOT RETAINED TO SOCKETS.

ITEM	QUAN	DESIGNATION	PART NO	DESCRIPTION	SPEC.	REMARKS
27	1		828C029-02	CONNECTOR ASS'Y.	9 PIN	MOLEX
26	1		854A021-02	POP RIVET		
25	1		836A009-01	TAB		
24	1		856A005-01	Hood & CONNECTOR KIT		
23	1	Not Shown	856B001-01	PACKAGING		
22	1	Not Shown	856A003-01	MOUNTING KIT		
21	1		857A003-01	LABEL, PROD. LIABILITY		
20	1		857A001-01	LABEL, IDENTIFICATION		
19	1		862A002-01	PLASTIC CAP		
18	2		836B006-01	FASTENER, DIP LOCK		
17			828C025-02	CONNECTOR ASS'Y.	9 PIN	MOLEX
16	1		828C009-01	CONNECTOR ASS'Y.	14 Pin DIP	
15	1		828C013-01	WIRE & TERMINAL ASS'Y.		
14	1		836A001-01	POWER CORD		
13	2		854A006-04	SCREW, PAN HD.	ST. STL.	#10-32 x 5/16 LG.
12	12		854A004-07	SCREW, PAN HD.	ST. STL.	#4-40 x 1/4 LG.
11	1		859A034-02	STOP TAB, ANGLED, RH		
10			859A033-02	STOP TAB, ANGLED, LH		
9	2		859A001-01	STOP TAB		
8	1		876D015-01	I/O B P/C BD. ASS'Y.		
7	1		876D001-02	MAIN P/C BD. ASS'Y		
6	1		880D002-01	SUB-ASS'Y. DISPLAY PNL.		
5	1		859D006-02	REAR PANEL PLATE		
4	1		859D007-01	FRONT PANEL PLATE	STL.	
3	1		864D008-01	CASE ASS'Y.		
2	1		———	ANALOG SENSOR ASS'Y., PER CUSTOMER ORDER, SELECT FROM 875D002		
1	—		800D010-01	FINAL ASSY. MODEL 711A		W/MAX. VALUE

THIRD ANGLE PROJECTION

PRINT DISTRIBUTION

NEXT ASS'Y | USED ON

APPLICATION

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED

	INCH	ANG.	CHAMFERS
1 PLACE DECIMAL ±	.1		
2 PLACE DECIMAL ±	.03	1°	1.5°
3 PLACE DECIMAL ±	.010		

MACHINED SURFACES MICRO INCH (R.M.S.) MAX.

MATL.

FINISH

DO NOT SCALE DRAWING. REFER TO DIM'S FOR STATED TOLERANCES. SEE STANDARDS MANUAL

DRAWN K.M.A. DATE 7/18/88

CHECKED DATE

APPROVED [illegible] RELEASED 8/1/88

FINAL ASSEMBLY

MODEL 711A, 712A, 713B

DRESSER INDUSTRIAL INSTRUMENT OPERATIONS
NEWTOWN, CONNECTICUT DRAWING

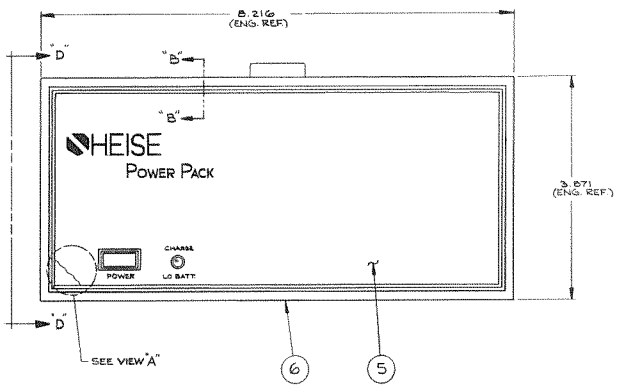
SCALE FULL | 800D010 SHT. 1 of 2 | REV. G

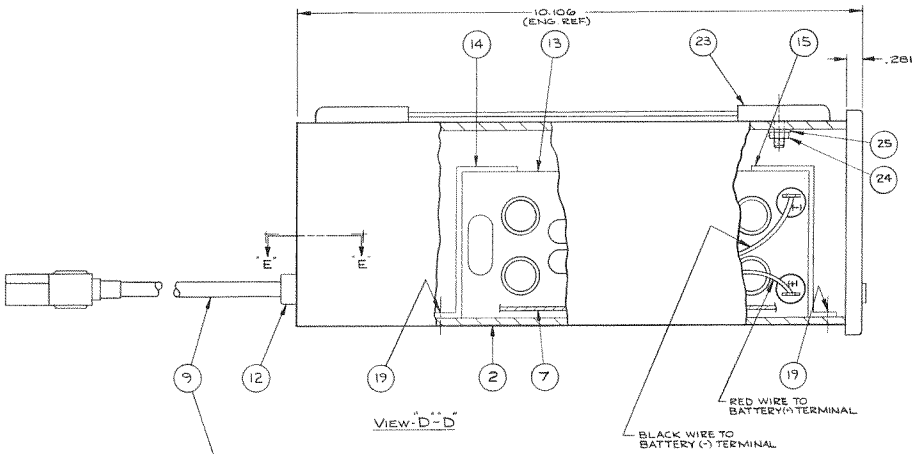
800D010 SHT 1 of 2

8 7 6 5 4 3 2 1

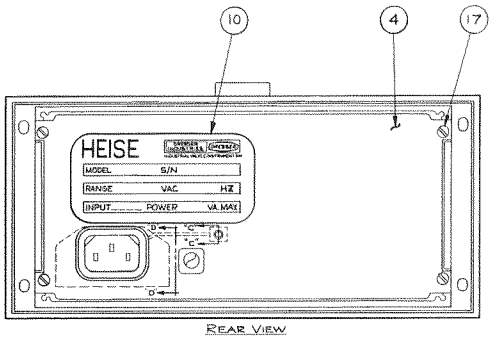
800D008

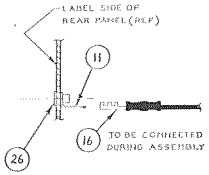
A	A1012	RELEASED		6/24/77
B	A1051	ITEM # 22 PART # WAS 854B009-01		7/15/77
C	A1055	DWG NO. WAS 800D001		7/20/77
D	A1076	ITEM # 8 PT # WAS 859A002-01		9/7/77
E	A1073	ADDED "-02 ASSY.		9/14/77
F	A1094	DELETED ITEM # 18 CHNG. PT # ITEM # 19		11/1/77
G	A1128	ITEM # 17 PT # WAS 854A020-07		1/4/77
H	A1133	SEE ECN		10/6/77

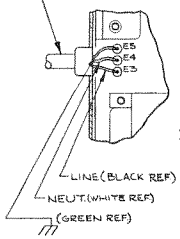


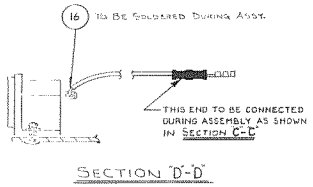


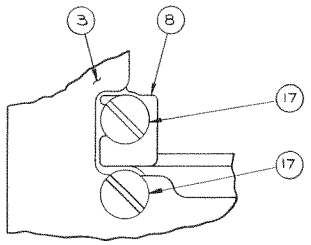
NOTE 1: ITEMS 24 & 25 ARE SUPPLIED WITH THE HANDLE (ITEM 23).

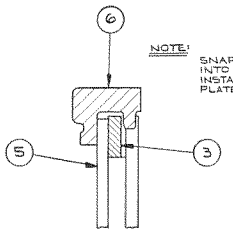












7	1	876D006-02	POWER PACK P/C BD. ASSY	—	—	220VAC
		SAME AS 800D008-01 EXCEPT DELETE ITEM # 7 AND ADD THE ABOVE.				
1	—	800D008-02	MODEL BP-1 POWER PACK	—	—	220VAC (REF)

26	1	854A021-02	POP RIVET			
25	—	—	WASHER, LOCK			SEE NOTE 1
24	—	—	NUT, #10-32			SEE NOTE 1
23	1	836B019-01	HANDLE			836B019-01
(NOT SHOWN)	22	2	858C004-01	BRACKET, MOUNTING	ALUM.	BLACK PAINT	858C004
(NOT SHOWN)	21	1	856A003-01	MOUNTING KIT			856A003
(NOT SHOWN)	20	1	856B001-01	PACKAGING			856B001
19	4	854A024-01	NUT, HEX, SELF-LOCKING	#4-40		854A024
18	4	854A016-03	LOCKWASHER, SPLIT RING	#4		854A016
17	8	854A004-07	SCREW, PAN HD #4-40 x 1/2 LG.			854A004
16	1	828B013-04	REC'P'T., WIRE, TERM. ASSY			828B013
15	1	858B002-02	BRACKET, BATTERY MTG.	ALUM.	CLEAR ANODIZE	858B002
14	1	858B002-01	BRACKET, BATTERY MTG.	ALUM.	CLEAR ANODIZE	858B002
13	1	836B018-01	BATTERY		12V/4.5AH	836B018
12	1	836D017-01	STRAIN, RELIEF	PLASTIC		836A017
11	1	836A009-01	TAB			
10	1	857A001-01	LABEL	ALUM.	MATTE	857A001
9	1	836A014-01	POWER CORD (MODIFIED)			836A014
8	1	859A001-01	STOP TAB	STL.	YELLOW TIN. CHRO.	859A002
7	1	876D006-01	P/C BOARD ASSY.			876D006
6	1	863D001-01	BEZEL	ABS	LT. MATTE	863D001
5	1	859C014-01	FRONT PLATE ASSY.			859C014
4	1	859C012-01	REAR PANEL PLATE			859C009
3	1	859D007-01	FRONT PANEL PLATE	STL.	YELLOW TIN. CHRO.	859D007
2	1	864C018-01	CASE ASSY.	EXTRUDED	BLACK VINYL	864C018
1	—	800D008-01	MODEL BP-1 PWR. PACK	—	—	110 VAC (REF.)

FINAL ASSEMBLY
POWER PACK
MODEL 705B

KMA 9/17/79
9-18-79

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FULL 800D008 H

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